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Kids Computer IQ Book

Eileen Buckholtz &
Dr. Joanne Settel

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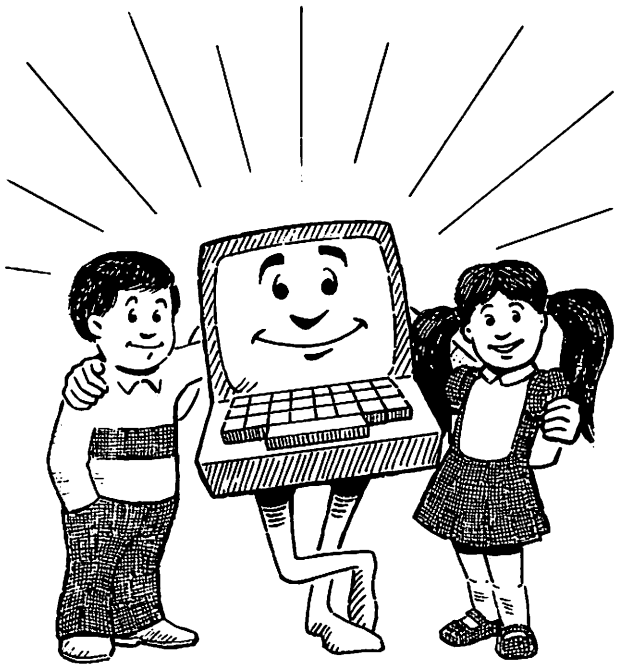

Eileen Buckholtz is a Computer Scientist, a writer, and the mother of two boys, David, age 8, and Ryan, age 3. She has been working in the computer field for over 15 years and is currently employed as a senior systems analyst for the Department of Defense where she manages a new technology branch. Mrs. Buckholtz earned an M.S. degree in Computer Science from the University of Maryland and a B.A. degree in Computer and Information Science from Ohio State University. She has lectured nationally and has written articles for major computer publications. As a fiction writer, Mrs. Buckholtz has published both adult novels and children's Micro-Adventures. She uses a home computer to write all her books. Her husband, Howard, is also a computer analyst and manager. It's no wonder that David and Ryan share their parents' interest in computers.

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by

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Howard W. Sams & Co., Inc.
4300 WEST 62ND ST. INDIANAPOLIS, INDIANA 46268 USA

FIRST EDITION
FIRST PRINTING—1983

International Standard Book Number: 0-672-22082-2
Library of Congress Catalog Card Number: 83-50176

Edited by: *C. Herbert Feltner*
Illustrated by: *Ron Troxell*

Printed in the United States of America.

Acknowledgments

We would like to thank the many people who made this book possible. Our husbands Howard and Barry provided support, encouragement, and help around the house when we needed it most. Ruth Glick contributed her valuable editing skills. Linda Hayes, of Columbia Literary Associates, helped throughout the long process from concept to finished manuscript. And our kids were great about trying out our games, puzzles, and hands-on activities. A special thanks goes to Ray Haygood, John Jackson, John Commito, Lynn Stratton, Susan Hlesciak Hall, Chassie West, 40 West Radio Shack Computer Center, The Memory Bank, and the Logical Choice who let us experiment on their computers. We also appreciate the photographs contributed by the following companies and organizations: Apple, Inc.; ATARI, Inc.; Commodore; Tandy Corp.; Texas Instruments, Inc.; Timex

Computer Corp.; General Motors; Johns Hopkins Applied Physics Lab.; Kurzweil; Giant Foods, Inc.; The National Oceanic and Atmospheric Administration (NOAA); and BOEING Commercial Airplane Company.

Preface

Kids, parents, and teachers, the *Kids Computer IQ Book* is a fun and enlightening introduction to computers. First, you will learn how computers work, along with some very important computer science concepts. Next, we will show you how to make a computer work for you. Then with a host of colorful examples, we explain how computers are being used at home, around town, and throughout the world and beyond. In the Fantastic Future section, you will discover the amazing ways advanced computer technology will change our lives in the years to come. And to get you started in the "computer age," we have included a special hands-on activities section on the most popular home computers. Puzzles, games, and a glossary round out the material.

Our goal in writing this book was to teach the basics of computers in terms you could easily understand. We use

everyday examples to show you the concepts. Through these pages, we hope to share with you the excitement and challenge of working, playing, and learning with computers.

EILEEN BUCKHOLTZ AND DR. JOANNE SETTEL

To David, Jenny, Maya, and Ryan

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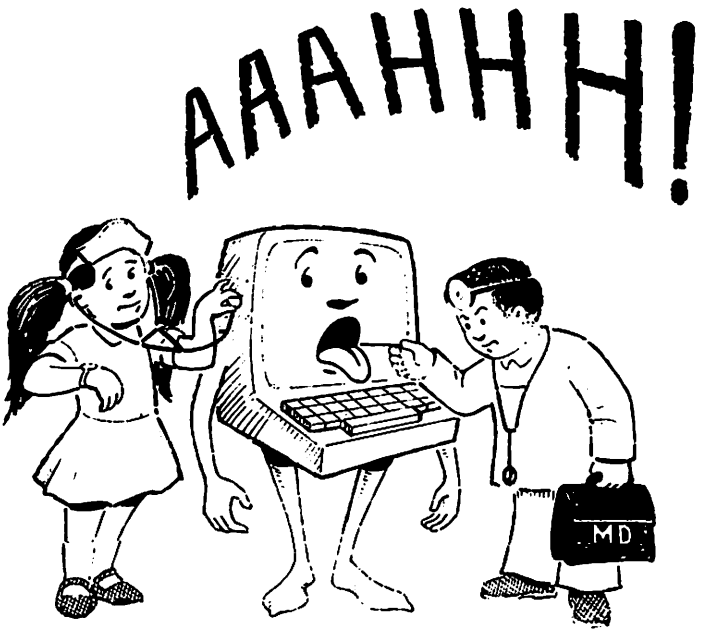
Introduction

What can play classical, country, and rock music? Is a champion at chess, the best at baseball, and a super soccer star? Can draw Mickey Mouse or design a car? Understands hundreds of languages? Can help land a space vehicle on the moon or help you land an A in math class? One more hint: it thinks faster than a speeding bullet. Is it Superman? NO! It's a computer.

It's hard to imagine that one device can do so many different things. But would you believe that a computer does even more? Take your home, for example. It's full of things that could make good use of a computer. How would you like to open your refrigerator door and have a little voice say, "The ice cream is all gone!" Or wouldn't it be fun if your doorbell played Frosty the Snowman at Christmas and Yankee Doodle on the Fourth of July? And how would you

like to call your best friend on the telephone by just pushing one button? If it should happen that the line is busy then your smart phone could automatically re-dial the number for you every 5 minutes until you tell it to stop. Do all these things sound like special effects from a science fiction movie? Well, they are not. They are just everyday items around the house that are now more useful because they have computers inside of them. And these are only a few of the many ways that computers are enriching our lives every day.



1 Computers Inside and Out

You are down to your last two rockets. You have been fighting the Wargongs for what seems like ages. The next few moves will decide who wins. You press the firing button, a light flashes, a bell rings, and four enemy ships vanish before your eyes. Now, with victory within your grasp you can feel your heart start to pound. Slowly you edge your ship dangerously close to a large Wargong vessel. The enemy fires at you, and misses. Then you launch your last rocket. Suddenly it's all over. You have saved the world and scored 3854 points.

You have been matching wits with a computer. But do you really know your opponent? Let's take a look inside this magic machine and see what makes it tick.

THE COMPUTER'S BODY

In many ways a computer is a lot like you. All of your body parts—your head, your heart, your eyes, and your legs—work together under the direction of the boss, your brain. Like you, the computer is also made up of lots of parts under the direction of a boss. The physical parts that are called the computer *hardware* are the parts that you can see and touch (see Fig. 1-1).

The computer *hardware* includes: Machines that get information into the computer called *input devices* such as:

- The hand control on a video game
- A punched card reader
- A typewriter-like keyboard

Fig. 1-1. Computer hardware. *(Courtesy Timex Computer Corp.)*

Machines that display or tell information from the computer called *Output Devices* such as:

- A tv screen
- A printer
- A mechanical voice box called a speech synthesizer

There is even more hidden inside the machine:

Central Processing Unit—This is the workhorse of the computer system. It adds, subtracts, multiplies, divides, and can even determine if a statement is true or false.

Memory—The place where the computer keeps its instructions and other information. Some examples of computer memory include:

- Chips
- Magnetic tapes that look like recording tapes
- Disks that look like records

THE COMPUTER'S MIND

The smart part of the computer that gets all the hardware units working together is called the computer *software* or program. The software is actually a set of instructions that tells the hardware what to do and when to do it.

For example, a computerized doorbell can play Frosty the Snowman by using software to control its hardware. In this case, the hardware consists of a small computer with bells that sound the notes of the musical scale as its *output* device. The software tells the doorbell what notes to play. The instructions for "Frosty" would begin: Play GEFGC Pause, Play BCDCBAG Pause. Using the same hardware, in this case the bells, you can easily change what happens when the doorbell is rung. All you need to do is give the computer a different set of instructions to change the doorbell's software. The software for "Yankee Doodle" would be Play CCDECED.

Software for your home computer usually is kept on a disk or tape cartridge (see Fig. 1-2).

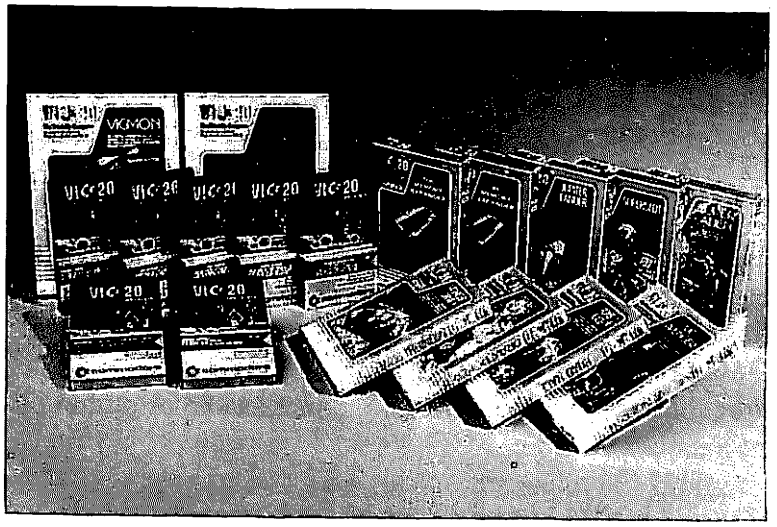


Fig. 1-2. Computer software.
(Courtesy Commodore Business Machines, Inc.)

HOW A COMPUTER REMEMBERS

The Tiny Chip That Thinks Big

You have probably seen pictures of computers as big as a room. You may have also used a small home computer about the size of a tv set. But would you have thought that you could hold the most important parts of the computers in the palm of your hand? It's true. The heart of today's modern computer is the chip (Fig. 1-3) or *microprocessor.* Chips are small pieces of silicon that contain thousands of circuits, transistors, and other electronic components (Fig. 1-4). A chip no larger than your fingernail might hold the main memory of a computer or be the math wizard of a computing system capable of doing a million additions in the time it would take you to sharpen your pencil.

On these tiny chips millions of pieces of information are coded using just two numbers—0 and 1.

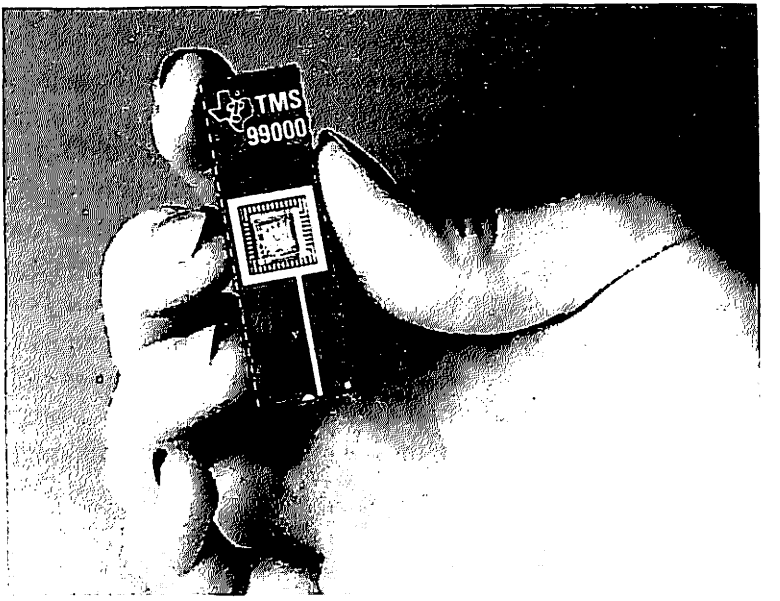


Fig. 1-3. The size of a chip. *(Courtesy Texas Instruments, Inc.)*

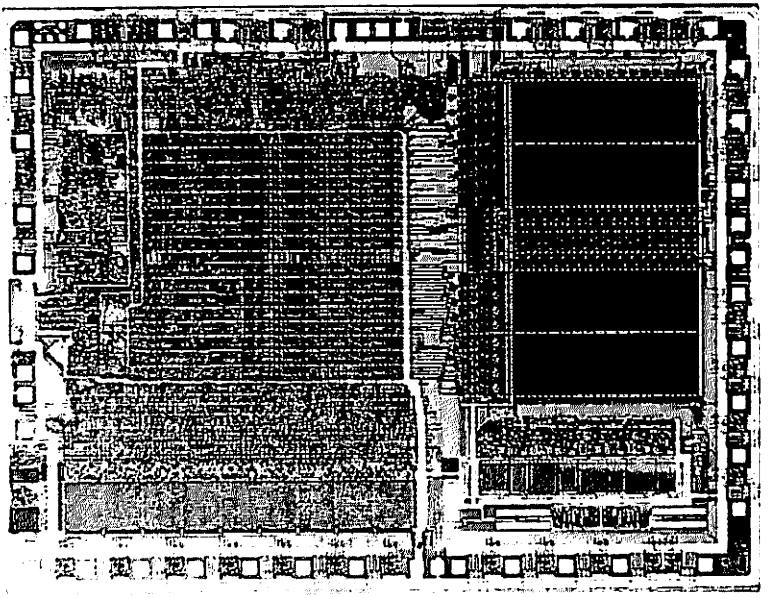


Fig. 1-4. A close-up of a computer chip. *(Courtesy Texas Instruments, Inc.)*

Every Little Bit Helps!

Imagine what it would be like if you could use only these digits, 0 and 1, for counting. To make things more difficult, imagine that these same two digits were all you could use to write words (Fig. 1-5). Sound impossible? Well, that is what a computer does. It uses the digits 0 and 1 to store any number and all the letters of the alphabet. Here is the computer's secret. It puts together a combination of 0s and 1s to make a unique code for each letter or number it wants to store. The code is called a binary code because it uses only two digits. Each binary place in the code is called a bit. A binary code for some of the letters of the alphabet might look like this:

Fig. 1-5. An Indian sending a binary message.

000 = A
001 = B
010 = C
011 = D
100 = E
101 = F
110 = G
111 = H

Using this code 001 100 011 = BED, can you decode this word?

010 000 110 100

(Q1-1 See Appendix A for answer)
Look at this code and tell what it is.

101 000 010 100

(Q1-2 See Appendix A for answer)

If you compare the codes for letters, previously given, and the ones for numbers, shown below, you'll notice something strange. The binary code 100 could mean either E or the number 4. How does the computer keep these straight? Its software knows whether a number or letter was being stored in the memory and processes it the right way—either as a numerical value or as a character.

The computer uses binary codes to store numbers that it may want to add, subtract, multiply, and divide. The computer's code for numbers 0 through 10 are:

0 = 0
1 = 1
10 = 2
11 = 3
100 = 4

101 = 5
110 = 6
111 = 7
1000 = 8
1001 = 9
1010 = 10

The computer uses base 2 arithmetic to convert from our normal decimal numbers to its binary representation of these numbers.

Can you guess what the code for the number 11 is? If you add 1 to the code for 10, you will have the answer 1011.

HOW A COMPUTER KEEPS TRACK OF INFORMATION

The World's Greatest Trivia Expert

The computer has an incredible memory for storing information. It can remember the names of every person in the United States. It can even learn a hundred new facts in a second and remember them all. Human adults don't even come close to this remarkable feat. Studies show that the average person can keep track of about seven new pieces of information at any one time. Try this simple test on a friend. Read the following list of words to the friend only one time.

- grape
- Chicago
- snow
- paper
- television
- Montana
- slicker
- dust
- elbow
- cottage

Now ask the following questions:

How many of the words can you repeat in order?
How many of the words can you remember at all?

Chances are your friend will remember between five and nine of the words correctly. However, our friend, the computer will go one better than just remembering the words—it will get the order right as well. The way that a computer keeps track of things so well is by keeping its facts in *data bases*. A data base is just a collection of information with a special added ingredient—organization! The secret to its success is that it's arranged so that if you know some of the information you need, you can quickly and easily find the rest.

To understand the idea of a data base, think of a telephone directory. If you know a person's name, you can find that person's address and phone number. A phone book is a data base and so is a dictionary. If you can spell a word, then you can find out what it means, how to pronounce it, where the word came from, and how to divide it. You have probably used data bases more often than you think (see Fig. 1-6). The tv guide, the table of contents in a book, a first aid manual are all examples of data bases. Not only can a computer store all the information in a telephone directory in its data base, but it could look up thousands of numbers in the time it would take you to open the book.

Another reason that computers are so good at managing a lot of information is the speed at which they can recall each bit of information. If you are imagining a computer speed reading through a thick telephone book every time it needs to look up a number, then think again. Instead of reading items sequentially (like you would read a book from first to last page) a computer can usually go directly to the exact place in the data base where the needed facts are stored and read just that entry. It puts its information in either primary

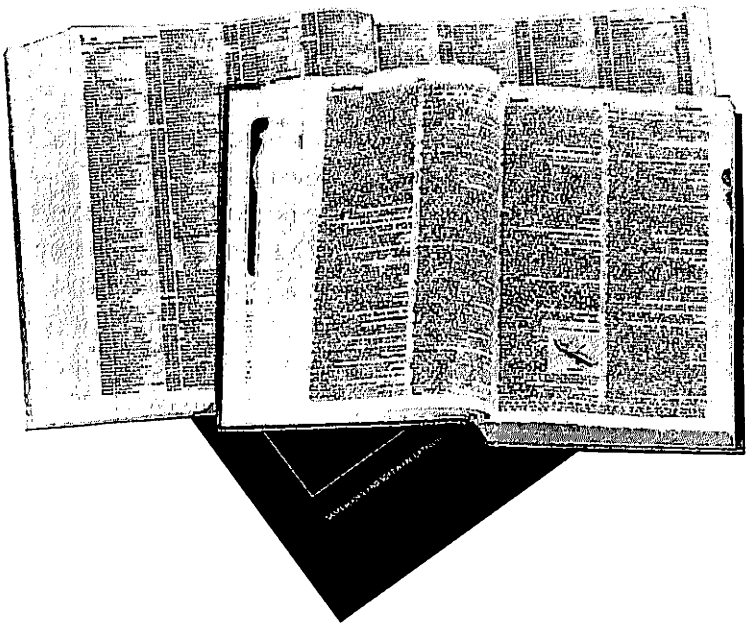
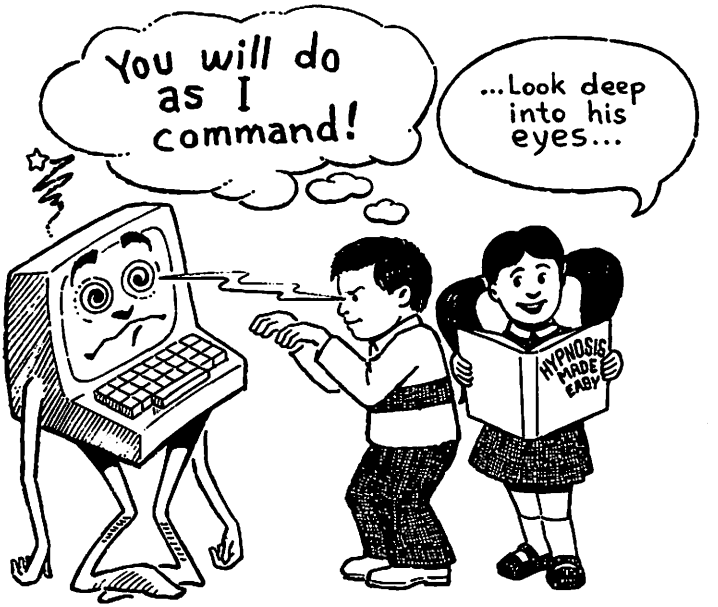


Fig. 1:6. Different kinds of data bases that you use everyday.

memory which is usually made up of chips or in bulk memory storage using disks or tapes. It can retrieve information from a chip in less than a millionth of a second. Memory on a chip comes in two varieties. Random Access Memory (RAM) can be written on and is used to store information that changes. Read Only Memory (ROM) can only be read and is used to store things that are not to be changed, such as the instructions that run a video arcade game or BASIC on your home computer.



2 Getting Computers To Do What You Want Them To Do

HOW TO TALK TO A COMPUTER

Congratulations! You have just talked your mom into letting you use the family's new home computer to plan tonight's dinner menu. All excited, you dash over to the terminal and type in a list of your favorite foods—pizza, pickles, french fries, bacon, hot-fudge sundae, pancakes, hamburgers, spaghetti, and peanut butter and jelly. You have just given the computer some input for your meal planning adventure. Then you press the computer's ENTER, RETURN, etc., key. With thoughts of golden fries danc-

ing in your head you anxiously await the computer's response (see Fig. 2-1).

"DOES NOT COMPUTE!" the computer's screen flashes in reply. Translated into English this means: I haven't the foggiest idea of what to do with this information.

Like any new person on the job, a computer needs instructions before it can begin to work. The set of detailed instructons that a computer uses to do its job is called the *program* or *software*. A lot of *software* has already been written for many of the things you would like your home computer to do and you can buy the programs at your computer store. The people who give the computer its instructions are called programmers. For this example, let's assume that you are going to write the menu program yourself—thus, the programmer is you.

To have your home computer plan supper, you the pro-

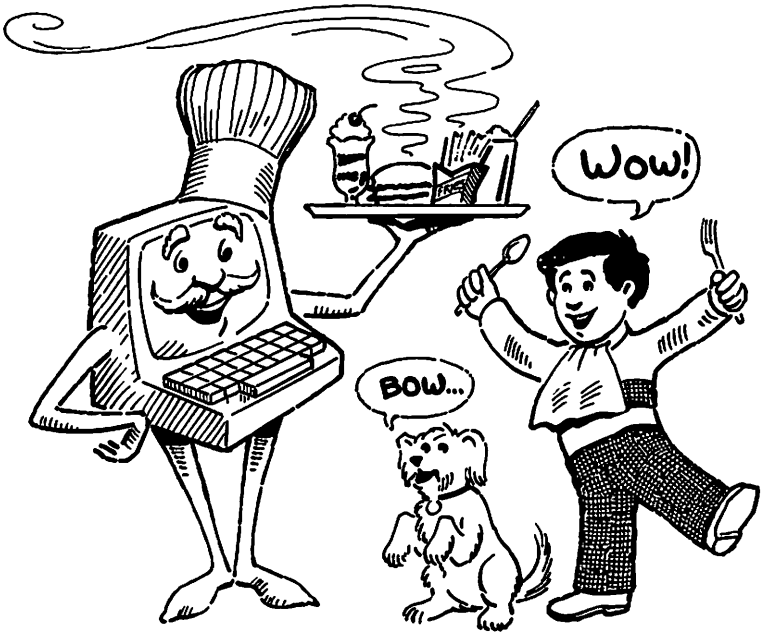


Fig. 2-1. A kid in front of a home computer. The computer hands him dinner.

grammer might tell it to pick three items from the list of favorites. You press the PRINT key. And out comes tonight's mouth-watering menu—pickles, bacon, and a hot-fudge sundae.

Obviously, you have not given the computer enough information. When programming a computer you can't take too much for granted. In order to plan a reasonable meal, the computer would have to know which foods taste good together as well as the difference between a main course and dessert. If your mom stuck her nose in while you were programming, she would probably add "don't forget the green vegetables!" To please your mom, the computer program would also have to know how to apply the rules of good nutrition. The computer is only as smart as the programmer who tells it what to do. The more you know about good nutrition, the more you can tell the computer. As the computer gets smarter, it will be able to do a better job of menu planning. In problem solving terms, the things that the computer has to do to the *input* to produce the desired results are called the *process*. If you program the computer properly, it should be able to plan a well-balanced meal that would receive even your mother's stamp of approval. Tonight's menu might look like this: pizza, tossed salad, hot-fudge sundae, and a tall glass of milk. In computer terms, the results of the menu planning process are called the *output* (see Table 2-1).

If you have ever tried to solve a big problem, you know

Table 2-1. Input, Process, and Output

Input	Process	Output
Your favorite foods Rules of Nutrition What goes together What is in the pantry	Plan Dinner	Menu Recipes for Mom List of ingredients

that it takes a lot of effort and planning. Sometimes the problem is so complicated, you don't even know where to begin. For large programming projects, scientists have developed an approach to designing systems called the *top-down* method. It works like this. First they try to break down the big job into its main parts. For example, if you were trying to solve the problem of cleaning your house, the main parts might be clean the kitchen; clean the bedrooms; clean the bathrooms; and clean the living room. Then each part is broken down into its parts. Clean the kitchen would break down into do the dishes; mop the floor; straighten the counters and pantry, etc. In the top-down problem solving method, scientists keep breaking down each task until it's a very understandable and reasonable job for a programmer or team of programmers. When you are designing a program, you can use the top-down approach, too. Just start with the big problem and break it down until you get to tasks that you know how or can figure out how to solve.

THE COMPUTER'S LAZY LANGUAGE

Now that you know how a computer works it should be pretty simple to get the computer to do something for you. Just sit down at the terminal and type in a set of instructions using the good ol' English language. Right? WRONG. The computer does not understand everyday English! In fact, talking to a computer is rather like talking to a kid from another country. Everything has to be explained in the simplest words possible.

Let's imagine that you have met a Spanish girl who has been speaking English for a short time. You play a game of chess together and at the end of the game you loudly announce "I beat you." She backs away and looks upset. She thought you were going to be her up. Then you smile and gently reach out to shake her hand. Finally, she understands.

Your Spanish speaking friend was confused because English words often have many different meanings. You had to use a different language, the handshake, to clear things up.

There are lots of English sentences that a foreign person might find confusing. Here are a few:

- Give me five.
- That breaks me up.
- I had a heavy date last night.

Can you think of a few of your own?

1.
2.

A computer is a lot like your foreign friend (Fig. 2-2). It does not understand sentences unless the words in the sentences can mean only one thing. In order to deal with

Fig. 2-2. A kid asks a computer "Do you speak Spanish". The computer answers "No I only speak BASIC".

this communication problem, computer scientists have designed some special languages just for talking to computers. These languages have funny names like COBOL, FORTRAN, and BASIC. Each of these names is an abbreviation for a longer name. For example, BASIC which is one of the simplest languages, actually means Beginner's All-Purpose Symbolic Instruction Code.

Let's examine a language that is supplied with most home computers, BASIC. The language uses a set of keywords such as READ, LET, PRINT, DATA to tell the computer what type of command to perform. BASIC (and other languages) also makes use of variables. Variables are symbols such as A, B, and C, which are used to stand for values that can change. Values that do not change are called constants.

A simple program will help to give you a feeling for how the language works. We will begin by writing a program that will get the computer to add the two numbers 135 and 867.

The program will be called ADD.

```
10 READ A,B
20 LET C=A + B
30 PRINT C
40 DATA 135, 867
50 END
```

Notice that each line in this program is numbered, 10, 20, 30, etc. The numbers are important because they let you identify every line. If you need to change a word in a particular line, you will have no trouble telling the computer where to find it (for example Go to line 20). If you don't use a line number before a statement the computer will execute that statement immediately after you press RETURN or ENTER . You must use line numbers if you want to type in a whole program before the computer does anything.

Each line in the program has a special meaning that the

computer understands. Line 10 says **READ A, B.** This tells the computer to read the numbers in the DATA line and make them equal to A and B. Thus, the computer will make A=135 and B=867.

Line 20 says **LET C= A + B.** This looks like a simple equation in math and it works the same way. It tells the computer to add A + B and to call the result (or sum) C. Thus, the computer will add 135 + 867 and make the result 1002 = C. The next line in our program, 30, says **PRINT C.** The computer will then print 1002.

Finally, the END statement simply informs the computer that it is at the end of the program.

Since the equation uses variables (A, B, and C), it's easy to have this program add any two numbers. Just change the values in the data statement. For example, if we change the data statement to DATA 900, 113 then run the program, the computer would set A= 900 and B= 113. The number 1013 would then be printed out for C.

Now see if you can write a program to add the three numbers 87, 66, and 25. (Hint! You will need to have another variable, D, for the third number. Now try to write a program that will subtract 25 from 100. You can check your answers in Appendix A (Q2-1).

The sample program was a very simple one. The language BASIC can also be used to program more complex problems. Here is a more challenging program that you can try. Program the computer to figure out how old you will be in the year 2000. HINT! You need to give the computer the following information as data:

- The year it is now.
- Your current age.
- Next have the computer subtract the current year from the number 2000.
- Then have the computer add the result to your current age.

- Have the computer print this result as your answer.
- You can check your answer in Appendix A (Q2-2).

HOW A COMPUTER DECIDES

Whether you realize it or not, you are constantly making decisions about what to do and when to do it. When you eat spaghetti, for example, you choose a fork or a spoon. But if you are eating fried chicken at a picnic or a hot dog at the ball game, you will probably choose to use your hands instead of eating utensils.

Computers often make decisions, too. They evaluate information and then take the appropriate action. For example, one procedure that the space lab's system might use could be stated like this:

- Evaluate space ship's course.
- If off course, then fire phaser rockets.

When a computer decides, it usually reduces that decision to one of two choices—true or false. Inside the system, a "true" might be represented as a "1" and a "false" as a "0". This fits nicely with its binary codes.

To tell if a statement is true or false, computers use a set of rules and special *logical operators*. You are probably familiar with +, −, *, /, operators in arithmetic and you know that 3 + 6 means to add 3 to 6. You have used logical operators before, too. You just probably didn't know it.

Here is how the computer uses this kind of logic. In programs, instructions for making decisions usually have two parts: an "IF" clause that defines what is being tested and a "THEN" clause that tells the computer what to do if the condition is true. Sometimes the IF clause is a simple condition like "spacecraft off course." If this part of the instruction is true, then the computer knows what to do—"fire phaser rockets." See if you understand this logic in a baseball

example. If you make three strikes, then you are called out (Fig. 2-3). What happens when you make three strikes? (Hint: pick out the action part of the statement.) What has to be true in this case before you are called out? (Now you are looking for the condition part of the IF statement).

Often there are several conditions that have to be met before an action is taken. So for decision instructions that have an AND in them, both conditions have to be true before the computer acts on the THEN clause. For example, if you hit a fly ball AND the fielder catches it, THEN you are out. In this sentence, what must have happened for you to be out?

Other times, only one of several conditions must be true in order to take an action. If you get hit with a wild pitch OR the pitcher throws you four balls OR you hit a single, THEN

Fig. 2-3. The umpire is a computer which says "You're out."

you get to first base. The logical OR operator tells the computer that at least one of the conditions needs to be met or true for the action part of the instruction to be performed. It's all right for more than one to be true, too.

There are other logical operators in addition to AND and OR. NOT is one of them and works like this. If it's NOT daylight, THEN go to sleep. If the condition daylight is false then NOT daylight is true.

Sometimes the decision making statement tells the computer what to do if the condition is false as well as when it is true. It does it like this: If the time is later than 6:00 a.m. THEN get up, ELSE go back to sleep. The action part after the ELSE clause says go back to sleep if the time is 6:00 or earlier.

Looking at a computer program, it's usually easy to spot the decision making instructions—most of them begin with IF. Here are some samples of statements pulled from several different computer programs. Which of them are decision makers? (Q2-4)

```
10 A=126
30 IF nighttime THEN go to sleep
40 IF A = 12 THEN go to 10
50 GOTO 30
60 READ A, B, C
70 IF your score = 100 THEN you win ELSE you lose
```

After you select the decision making instructions, try to pick out the condition part and the action part. The answers are provided in Appendix A.

Now you are ready to try composing some decision making instructions for yourself. See how many of these you can write down for rules around your house. Examples:

1. IF I keep my room straight THEN I get my allowance.
2. IF I eat all my vegetables at dinner THEN I can have dessert.

In addition to logical operators (like AND, OR, and NOT) and arithmetic operators (like +, −, ×, /), the computers also use relational operators. The relational symbols >, <, = are for comparing values of variables. The > symbol means greater than. So A > 25 means A greater than 25. The < symbol means less than and = means equals. These kinds of symbols are often found in the decision making part of the IF clause. Look at the absolute value program below. Can you see a line that has a relational operator in it? As you get more involved with programming, you will find that these types of comparisons are very handy for getting the system to do what you want it to when you want it to.

Here is an easy program for getting what is called the "absolute value" of a number. The absolute value of a number is the same as that number if the number is positive. If the number is negative, then just take away the minus sign to get its absolute value.

```
10 INPUT A
20 IF A < 0 THEN A = -A
30 PRINT A
40 END
```

The branch of mathematics that deals with decision making is called BOOLEAN LOGIC and if you are interested, your school or public library should have books that go into more detail on this subject.

GETTING PROGRAMS TO WORK

One summer day about 30 years ago, several computing pioneers were trying to get the Mark II, one of the early computers, to work. It took a while, but after probing inside the large machine, they finally uncovered the source of their problem. It turned out to be a tiny moth that had gotten caught in the circuitry. After removing the insect, or

debugging the computer, as one of the programmers jokingly called their effort, the machine worked just fine! The term debugging stuck and now programmers call anything that keeps a program from working as it should a *bug*. The process of getting a program to run correctly is called *debugging* (see Fig. 2-4).

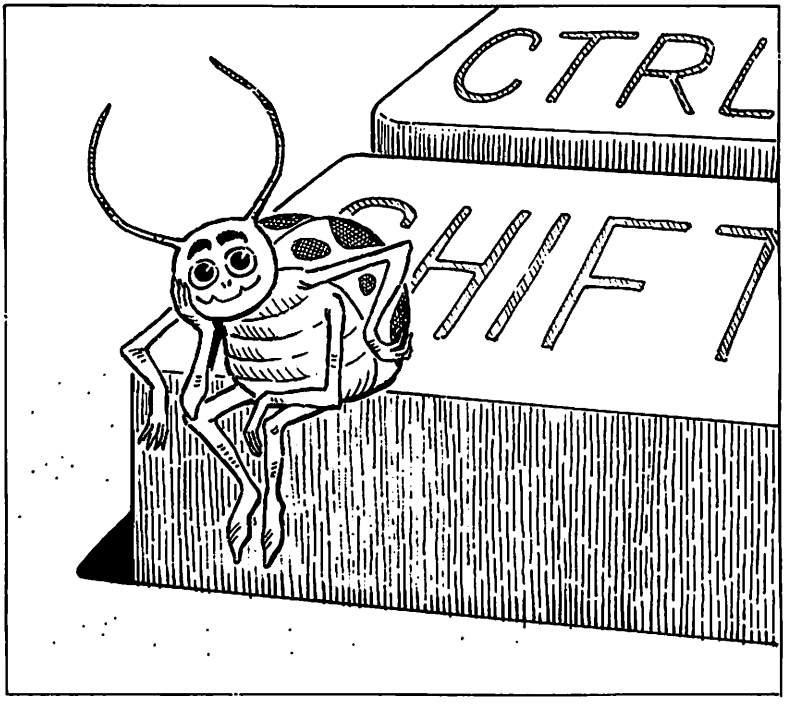


Fig. 2-4. Drawing of bug on a computer.

From what you know so far, programming may sound like a snap. And for very simple tasks, that is true. But for complex systems like the ones that guide astronauts to the moon, control robots on assembly lines, or even challenge you to your favorite video game, getting the programs to run correctly takes a lot of skill and effort. But debugging can also be fun. It's like finding the important clues and solving an intriguing mystery. And if you do a thorough detective job, you will even get a reward—a program that works!

There are several methods programmers use to find errors in their programs. Desk debugging, for example, is done by hand without the computer. You can try this yourself, even if you don't have a computer. First, you read each line of your program and pretend you are the computer by performing each command. You write the results of each line on a piece of paper and also keep a list of the values of every variable. Here is how this method works. Suppose you had a program that added two numbers and printed out the answer.

```
10 INPUT "type in 2 numbers"; B,C
20 LET A = B + C
30 PRINT A
40 END
```

	On paper you write:		
	A	B	C
For line 10, let's say we want to tell the computer that B is 28 and C is 30.		28	30
For line 20, we add 28 to 30 and assign that sum to A.	58	28	30
For line 30, we print the value of A which is 58.	58	28	30

On paper you would have a column for the values of A, B, and C. And as you go through your program by hand, you keep track of the new values of these variables. While desk debugging, you should also look for errors in logic and typing errors from when you wrote the program. When you are satisfied that the program really does perform as you meant it to, then you are ready to try it on the computer.

If your program does not run correctly on the system, you can try your skill at computer-assisted debugging. Many programming languages have debugging options built within them that allow you to follow the logic of the program and print out new values every time a variable changes. Look in the programmer's reference book under "DEBUG", "TRACE", "BREAK", or "DSP" for directions on how these features work on your home computer. Using these options is similar to the desk debugging method, only the computer keeps track of the changes for you. If you are using a programming language that does not have any of these features, you can get similar results by putting in extra PRINT statements after sections of your code to display values of your variables.

See if you can find the bugs in the following programs.

PROGRAM 1 The Sum of Three Numbers A, B, C (Q2-5)

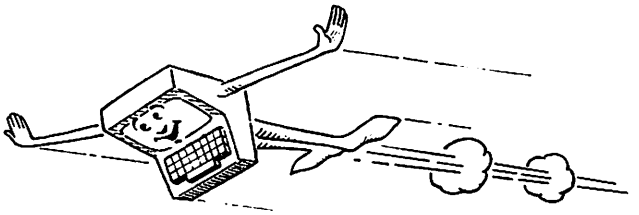
```
10 INPUT "type in 3 numbers"; A,B,C
20 D=A+B-C
30 PRINT "The Sum Is " D
40 END
```

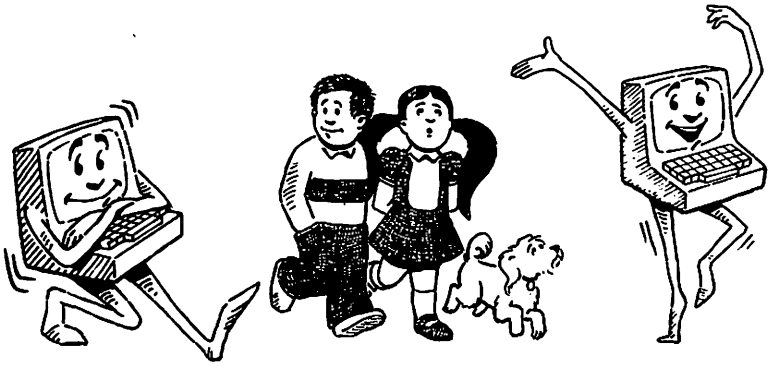
PROGRAM 2 Pick The Largest Number (Q2-6)

```
10 INPUT "type in 2 numbers"; A,B
20 IF A > B THEN PRINT A
30 IF B > A THEN PRINT A
40 END
```

Hint: What happens when A = B? Also try inputting a larger B. Check your answers in Appendix A.

Note: If you want to try running these programs on your home computer, check the BASIC reference book for your model. There will be minor differences in instruction format.





3 Computers Are Everywhere

THE SUPER COMPUTERIZED HOUSE

Question: How do you unlock the door of a computerized house?

Answer: With one finger.

Imagine what your life would be like if you could live in a house filled with computers. "Pretty incredible," you say? Well, let's find out, by taking a trip through a super computerized house. As we walk through the rooms, many of the amazing things that we observe will seem as if they belong

in the future. Don't be fooled. Most of what you will see could actually be put into a house of today. Of course, it would be pretty expensive to fill a house with these marvelous machines, but the average home could easily have one or two of the things that we will be describing.

Welcome! We are now at the door of your family's new computerized dream house. No need to fumble around in your pocket for a key. Just punch your special code number into the keypad on the front door. Since everyone in your house has his or her own special code number, the computer built into the front hallway knows who you are and will greet you by name. Then with a click, the door will open (Fig. 3-1).

Now, don't bother reaching for the light switch when you walk into the house because the central computer of the house has already turned on the hall lights for you. In fact,

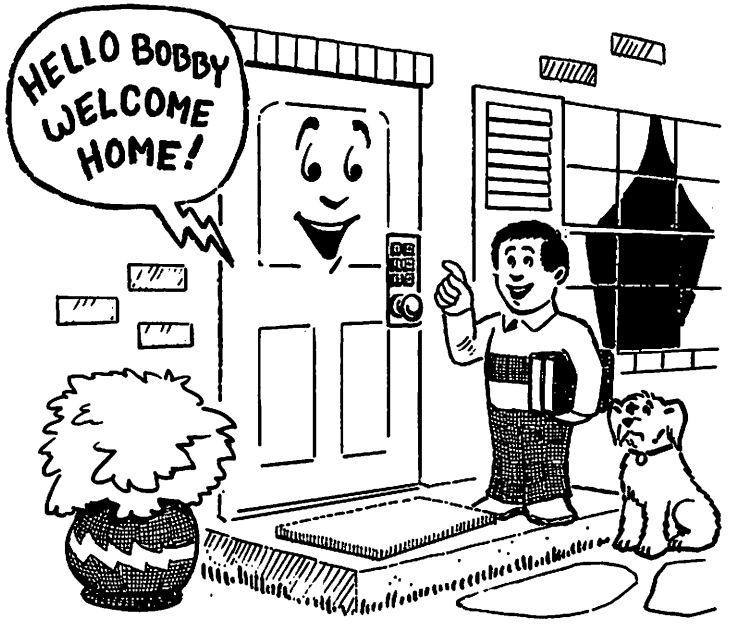


Fig. 3-1. A boy comes to the door of his house. The house says "hello Bobby, welcome home."

the computer seems to follow your every movement, turning on the lights in a room as you enter and turning off the lights behind you. Could it be that the walls have eyes? Well, in a way they do. Electronic eyes found in every room of the house sense your presence and let the computer know exactly where you are.

As you enter the den you will want to take off your sweater and shoes and get cozy. Just go right ahead. There is no need to worry about being cold. The computer has been programmed to warm up the house for you 30 minutes before you get home from school. It has also opened the shades on the west side of the house to let in the afternoon sun. This both brightens the house and helps to heat the rooms as well. Taking advantage of sunlight is one way your "smart" computer can help your family save money on heating bills.

Now, while you are relaxing, you will probably want to get yourself a bite to eat. Don't feel like rummaging around in the refrigerator to find something good? No problem, just ask your friendly computer. In a few seconds it will print out a list of snacks for you to choose from. The computer has been programmed, not only to "know" what foods are in the kitchen, but also to "know" which foods would make good snacks (Fig.3-2).

Care for some music? And how about some colored lights that dance across the room in time to the beat? All you need to do is turn on your stereo and your living room computer will provide entertainment just for you. It will even pick the right lights to fit the mood of the music that you are playing.

While you are listening to the music you might want to challenge the computer to a game of monopoly. Or how about using the computer to help you understand your math homework?

All this may sound fantastic, but actually it's only a small sample of what computers can do in today's home. That computerized kitchen, for example, functions as a super

Fig. 3-2. Computer in the kitchen.

cooking assistant. It can help select a well balanced menu for a particular meal. And, when the cook is away, it can turn appliances on and off at preset times. This electronic chef can even sense when food is beginning to burn and turn the heat off in a jiffy.

Not only can it keep you well fed, this modern home computer can also ensure your family's safety. Using special heat and motion detectors the computer can spot a burglar even before he gets into your house. The watchful machine will also set off an alarm and notify the police.

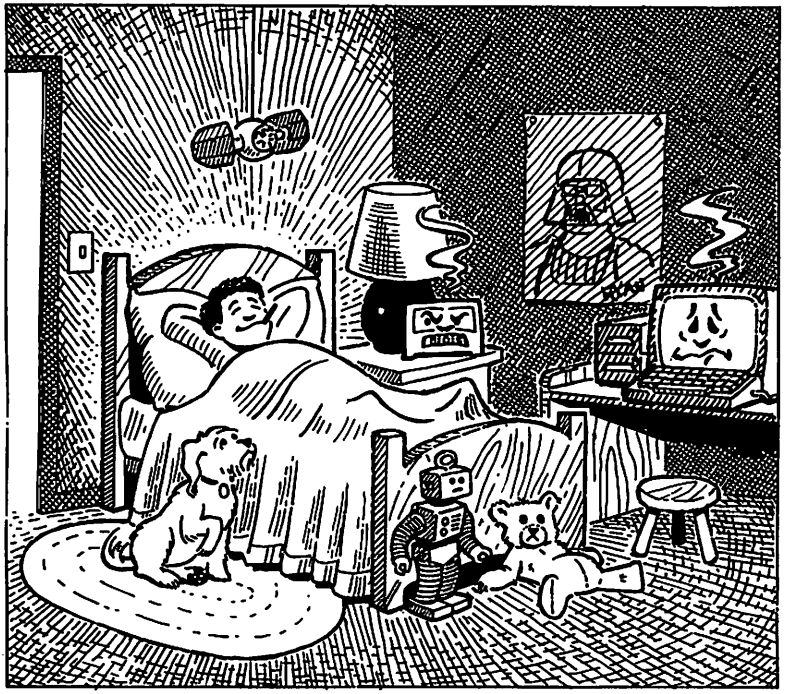
You may be surprised to learn that there are actually a few super computerized homes in existence today. No, they are not for sale. Not yet anyway. They are designed for show and are open to the public. One of these "Homes of the Future" is called "Ahwatukee" and is located in Phoenix, Arizona. A second futuristic home is called "Xanadu" and is in Orlando, Florida.

What else can home computers do? Here is an exercise for you. Try to list 10 ways that computers could be used to make life easier in your home. Fig. 3-3 shows a room in a futuristic home.

We have listed some ideas in Appendix A (Q3-1).

COMPUTERS ABOUT TOWN

Computers are popping up in the most surprising places all around town. Take your neighborhood grocery store, for example. On the shelves are cans and boxes wearing special identification tags that tell the store's computer what they



..."Ryan won't be coming to school today. His talking alarm clock got mad and isn't speaking to him. The family's home computer is on the blink so he couldn't do his homework. The microwave sizzled his breakfast and his electronic astrology forecast says he'd better stay in bed."

Fig. 3-3. A room in a futuristic home.

are. Take a look at a can from your pantry. The black and white thin and thick bars on the back of the label are called the Universal Product Code (UPC) (Fig. 3-4). This code can be read by a device called an *optical scanner,* which can be found at the supermarket check out counter (Fig. 3-5). The computer uses the UPC to identify each product, check the list of current prices in its memory, and then charge you the right amount for that item (Fig. 3-6).

Fig. 3-4. Illustration of Universal Product Code.

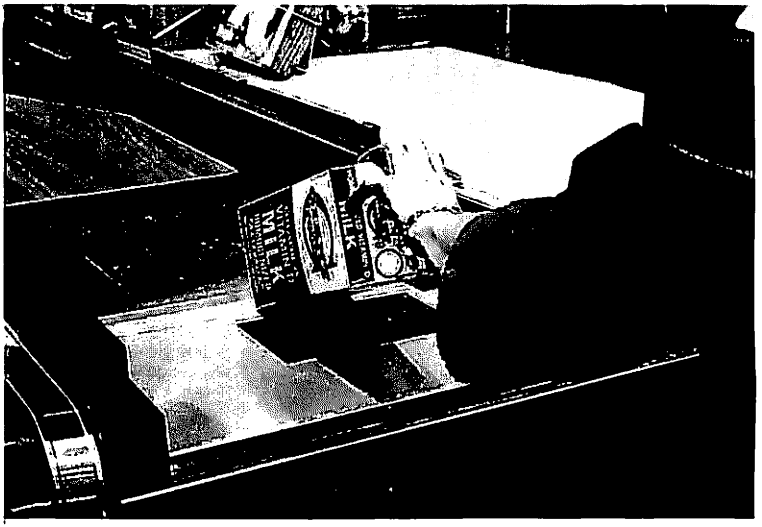


Fig. 3-5. UPC being scanned by optical scanner.

Fig. 3-6. Optical scanner being used at supermarket check out counter.

The system also helps stock the shelves. And in some places such as warehouses, that means sending computer controlled robots running up and down the aisles storing and fetching items from specific locations. Another way computers help the store manager is by doing automated *inventory control.* That means that the computer keeps track of how many units of each product have been sold and compares that to the numbers of each item that are still on the shelf. When the shelf count gets low, the system automatically sends in a new order for more.

This same idea of marking items with bar codes is used in drug stores, hardware stores, department stores, and even libraries. BEWARE! Now the librarians have a special assistant who knows immediately if you have forgotten to return an overdue book. But checking up on you is not all the automated library system can do. It can also help you locate a book on sunspots, pirates, Alaska, or just about any subject instantly. And if you want a book that has already been

checked out, you can find out when the book is due back in and put your name on the waiting list—all from a computer terminal.

How does the library's automated system know so much? For one thing, it has a large data base that contains information about all its books and magazines as well as all its patrons (that is, the people who use the library). For identification, a unique bar code is attached to each book, magazine, record, movie, and patron that belong to the library. Of course, the library users like yourself don't have to wear a UPC code to check out a book. The patron id is part of your library card. Librarians also use the system to order new books for you to read. Next time you are browsing for a good book to read, stop in and say "hi" to your library's very helpful computer.

Like the supermarket and the library, the post office uses computers to improve its service. But instead of reading bar codes, mail systems use optical character readers (OCR) to sort through letters by addresses and ZIP codes. Most of the mail that goes through the postal system is typed or machine printed and that helps the computer to "read" the addresses. The handwritten envelopes are not yet handled by the automatic systems, but computer experts are working on devices that one day will be able to make out even a doctor's handwriting with ease. To improve service, the post office is implementing a longer nine digit code that will direct the mail to your very own block instead of just to your local post office as it is done today.

At the bank, computers are hard at work taking care of people's money. When you write a check to a friend and he deposits it into his account, do you know what happens? The transfer is usually done by electronics and no paper money actually is exchanged. The banks use a process called Electronic Funds Transfer that gives them a computer record of the transaction and the approval to credit your

friend's account with the amount of the check being subtracted from your account. Overall balances between banks are settled on a daily, weekly, or monthly basis. Now with Electronic Funds Transfer speeding up the banking process, you had better make sure you have money in your account to cover the checks when they are written.

Some banks are offering services where you can pay your bills right from your telephone. You use the numbers 0–9 and symbols * and # on your touch tone phone to tell the computer which bill you want to pay and how much you want transferred to that creditor. You can even call up your bank and ask about the balance in your checking account, without ever saying a word. The automatic teller will "tell" you the balance with its voice synthesizer.

Other places around town are turning your telephone into a computer terminal, too. Some catalog stores let you order everything from clothes to tennis rackets by entering the appropriate item numbers and your charge card numbers into your hand-held terminal.

Did you know that computers can also be used to fix things? Down at the garage, mechanics use computers to help diagnose problems in new model cars. Most new cars have a number of computers hidden inside as well. They are used to give the driver information about doors being left open, headlights that are out, trouble in the engine, and trip records. And when hooked up to the analysis system at the garage, the car's tiny, internal processors provide the mechanic with the inside story on why the car is not working properly and what has to be done to correct the problem. So, even if you don't yet have a home computer, you might already have several little ones parked right in your garage.

The police, fire, and traffic control departments all have computers on their staff helping to run the city. When a highway patrol officer stops a person for speeding, he will know quickly if that person has had a recent ticket. From his

patrol car, the officer can check the person's driving record by calling in a request on his radio to the data base at headquarters. The police also keep records of criminals and reported crimes so that they can solve cases more rapidly.

At the fire station when an alarm sounds, it's not just the fire fighters who are ready for action. Twenty-four hours a day, the fire department uses its computer systems to dispatch emergency equipment where they are needed. And then there are the computer controlled traffic lights and lane indicators that help minimize traffic at rush hour jams by adjusting the flow of cars.

From stores to stoplights, wherever computers are found around your town, you can be sure that they are helping to make your life run a little more smoothly.

THE WORLD AND BEYOND

Computers are everywhere—from hospitals and weather stations to airplanes and rocketships headed for the planets—giving us information at the snap of a finger and helping us explore places that were once beyond our reach.

Weather Forecasting

"Expected temperatures today will be in the mid to upper 40s. There is a 30% chance of showers and winds will be gusting from the Northwest at 15 mph." That is your friendly weather forecaster talking. Ever wonder how he knows so much? Well much of his information is gathered by the computers at the National Meteorological Center in Maryland. These computers get their data from sources all over the world.

One source of information is weather balloons. Hundreds of these giant helium filled balloons (often mistaken for UFOs) are sent up into the air every 12 hours from weather stations world wide. They float through the sky gathering

data on temperature, winds, air pressure, and water vapor. As the balloons reach 60,000 feet they burst. In the meantime all the valuable data they have collected has been broadcast back to the meteorological computer.

While the giant balloons are hard at work sampling the air, four weather satellites are also busy transmitting pictures of cloud cover to earthbound computers. The pictures show weather forecasters how clouds are moving across the country. These same satellite pictures can be seen by the public on the daily television weather reports.

The national weather computers also receive information from ships at sea, airplanes in flight, and weather stations on the ground. Once all these reports have been digested by the computers, the marvelous machines print out a generalized weather report. The human forecaster, however, still has a job to do. He must interpret the computer's predictions to suit his particular part of the country (Fig. 3-7).

All this results in moderately accurate weather information for today and tomorrow. The long range forecast, however, is often still off target.

What will the future bring? Impovements in computer

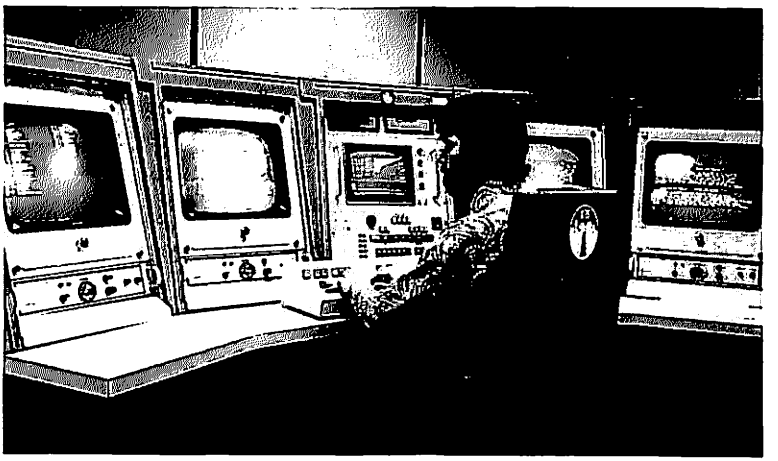


Fig. 3-7. National weather computers receive variety of information.

technology should provide us with very accurate weather information for four-day periods and good predictions for two to three weeks. Further computer advances may bring weather warning systems right into our homes. If a natural disaster such as a flood, a mud slide, or a tornado is threatening a particular town, a computer might be programmed to ring all the telephones in the area that is threatened. People could thus be warned to evacuate.

Computers in the Air

In 1903, before modern computers ever existed Orville Wright took the first airplane on a bumpy flight through the sky. The plane was airborn for 59 seconds. Today, computerized airplanes stay in the air for hours and fly hundreds of passengers around the world smoothly, comfortably, and efficiently (Fig. 3-8).

Fig. 3-8. A computerized airplane.

You will probably be amazed to learn just how many computers are involved in a typical airplane flight. There are over 130 computers aboard the BOEING 767, one of the newest jetliners on the market. Some of these computers assist the crew in flying the aircraft. A pilot can direct a special management computer to coordinate either a speedy flight or a slower fuel efficient flight. The computer will then take over the ordinary details of flying the plane, leaving the pilots to concentrate on other essential aspects of the trip.

Computers also manage important parts of take offs and the landings. Eight separate computers measure wheel speed and assist the plane in braking smoothly.

Other BOEING 767 automated systems help to create a comfortable environment for the passengers by regulating air pressure and temperature and by adjusting sound and lighting levels in the cabin (Fig. 3-9).

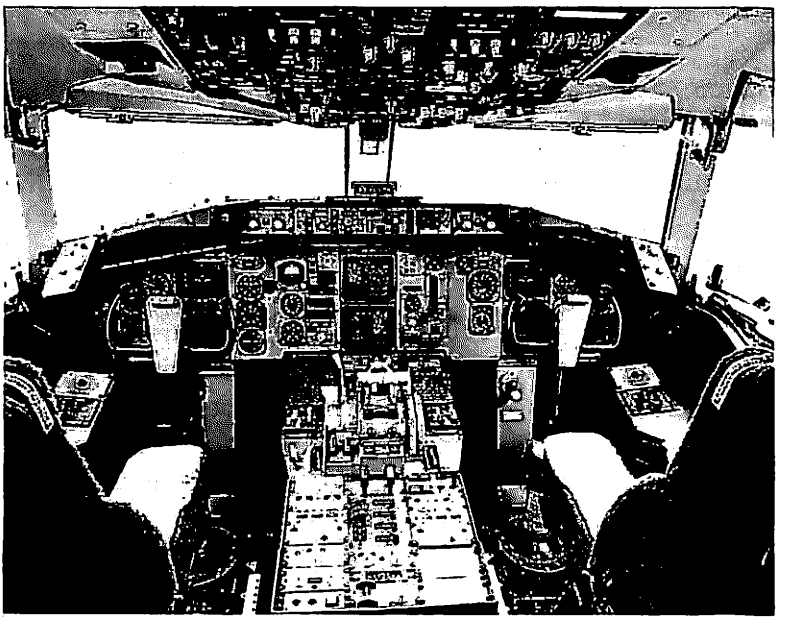


Fig. 3-9. The cabin of a computerized airplane.

In addition to all the computers inside this marvelous plane, there are even more which assist the plane from the ground. At many tracking stations around the country they help specially trained controllers to direct air traffic by gathering information from radar, radio transmitters, and other sources and following the flight path of a particular plane to make sure that it remains at a safe distance from any other aircraft.

So far we have seen that there is a lot of computer power involved in getting a plane from one city to another. But that is only part of the story. Months before a particular flight even gets off the ground, airline ticket agents are using automated systems to coordinate ticket sales and reservations. From their terminals, agents can receive almost instant information on special fares, flight departure times, seat availability, and meal service. They can also book you on a flight almost anywhere in the world.

Space

Computers in space? You bet! In fact, it was computers that guided America's Apollo space flight all the way to the moon, and safely back to earth again. For example, prior to take off scientists used computer enhanced photographs to examine the surface of the moon and determine the best spot for landing. On board the spacecraft astronauts used computers to determine how to adjust their orbit around the moon, their landing on the moon, and their return home. When the spacecraft needed to change its course, the computers initiated these changes by turning the engines on and off at the proper times.

At the Mission Control Center in Houston a huge complex of high speed computers has served as a navigating and guidance system for most of our space missions. These earth based computers continuously monitor a flight and rapidly

alert ground control if something goes wrong. Without the aid of small, highly advanced computers, America's space program would have barely gotten off the ground.

Medicine

Jean Smith is a heart patient who has a tiny device called a pacemaker implanted in her chest. The pacemaker keeps her heart beating at a constant rate. Her doctors need to check the pacemaker regularly to make sure that it is working properly. But Jean does not have to leave her house to be checked. She simply calls the hospital computer. Then she places a small computer on her chest and the telephone receiver on top of it. The hospital computer can pick up signals from Jean's pacemaker and determine if the little machine is doing its job well. If there is a problem, her doctor will call and ask her to come in for further tests. If all is going well, however, this automatic house call will have saved Jean both time and energy.

Another heart patient is lying in a hospital bed recovering from a serious operation. Suddenly, the computer terminal to which the patient is hooked indicates that his heart rate has dropped below a critical level. The machine sets off an alarm, alerting a hospital emergency team to go into action. Soon the man's heartbeat is brought back to normal. A monitoring computer has saved his life.

In hospitals around the country, computers like these watch over critically ill patients, tirelessly keeping track of a person's body temperature, heart rate, breathing, and other body processes, nonstop for 24 hours a day. By sounding an alarm when things go wrong, these devices routinely save lives when every second counts.

The computer's incredible memory assists in another area of medicine. It can be programmed to store long lists of illnesses and their symptoms. A doctor just types in his

patient's complaints and within seconds the system will print out all the diseases that the patient may have. In addition the computer might suggest medications to use and further tests which could be done.

Now, don't get the idea that computers can replace your family doctor. A doctor's judgment and experience are critical in diagnosing the unique problems of a wide variety of different kinds of people.

Still, the computer's memory makes it astonishingly efficient, because it has more information "at its fingertips" than any one person could possibly keep in his mind.

At the same time other computers busily work behind the scenes in medical laboratories. Computers perform hundreds of blood, urine, and cell tests each day. Computers perform with great speed and accuracy, getting the results back to the physician often within the same day.

Computers and the Handicapped

Tom is totally blind, yet now he can read any book in the library! For years he was only able to read the limited number of Braille books that were available. Braille is a special language in which words are punched in a series of raised dots. A blind person reads a word by touching the dots with his fingers. Tom's library has just purchased a computerized reading machine (Fig. 3-10). This amazing device can actually scan a page from a book and read the words out loud. Tom uses special buttons to control the machine. He can slow down or speed up its reading rate and he can even get it to repeat a word or sentence for him. The reading machine has opened up a whole new world for Tom.

Beth can move her wheelchair in any direction that she wants by simply turning her head! She's making use of a new invention created by a group of graduate students at

Fig. 3-10. Blind person using a reading machine.

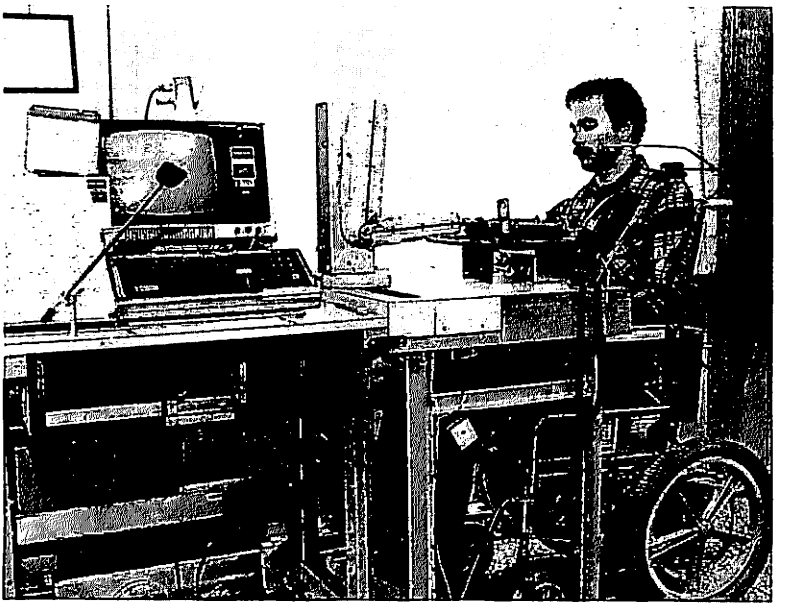
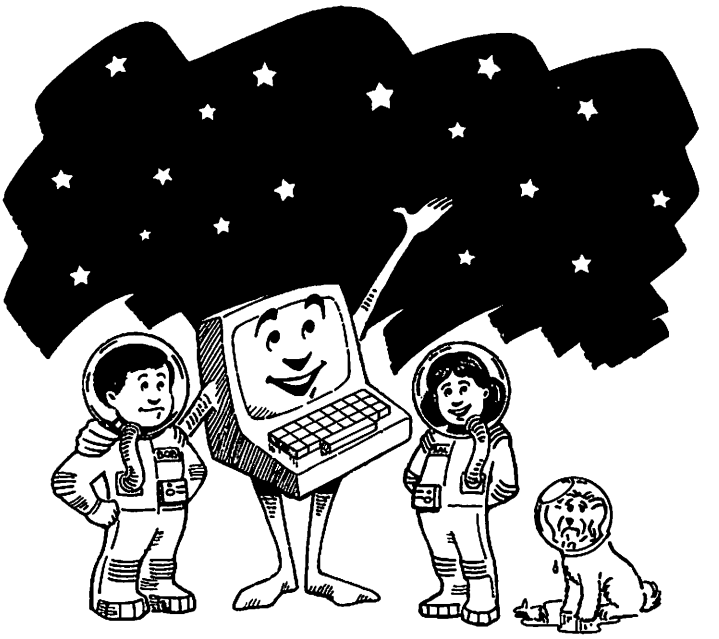


Fig. 3-11. A computerized, voice controlled, mechanical arm being operated by handicapped operator.

Stanford University. This "smart" wheelchair uses special photo sensors that pick up the movements of the operator's head. A tiny built-in computer translates this information and directs the movements of the wheelchair. Though this special machine is not on the market yet, it will be soon. Then, people like Beth who have little or no use of their arms and legs will be able to propel themselves smoothly and comfortably from place to place.

Here is another super invention. The handicapped will soon be able to flip on lights and appliances without lifting a finger by using computer operated switches, which turn on and off in response to voice commands.

And how about a computerized, voice controlled, mechanical arm that can cook a dinner and even feed it to the handicapped operator? This incredible arm, which is pictured in Fig. 3-11, is sure to make life better for many disabled people.



4 The Fantastic Future

CAN MACHINES THINK AND LEARN?

Off the coast of the icy North Sea, a worried oil engineering supervisor puts six months of grueling work on the line.

"What 'ya say, Sam?" the engineer asks turning to his expert geologist. "Should we drill another 20,000 feet or close up shop for good?"

A few seconds pass as Sam methodically analyzes the instrument's readings, sorts through the available information and compares the findings to past experiences. "Go ahead

and drill. Probability of success is 95%," Sam reports back without blinking an eye.

"That's all I need to know," the engineer says as he gives the signal to resume drilling. His worried expression has been replaced by an optimistic smile. With an expert like Sam around to help, his own job is a lot easier.

Have you guessed that Sam is a computer? Well, he is—and a very smart computer, too. For years, scientists have been fascinated with the idea of creating "smart" machines—not just sophisticated adders, but machines that could really think. But before they could achieve this goal, they had to understand how humans think and what it takes to become as "smart" as an expert. In a field of computer science called Artificial Intelligence or AI for short, scientists are creating systems like Sam that can function as experts in subjects like geology, medicine, machine repair, and computer design.

The first Artificial Intelligence experiments started out playing games—some of the same ones that you play on today's home computers and video games. The original chess and checker playing programs were lucky to beat even a good beginner. But they improved their skills by "taking lessons" from an expert. To teach the computer how to play chess, a chess master and a computer programmer first worked together to develop a "knowledge base" on how to play the game. The programmer picked the chess expert's brain, in order to learn how the expert chose to make a particular move. All this information on decision making was translated into rules the machine could understand (Fig. 4-1).

Then as the computer began to play the game, it used a form of self-teaching, called "heuristic learning," in which it actually learned from its own mistakes. Whenever it chose a move that resulted in losing, the program eliminated that choice from its set of possible moves given the same board. Thus, it never made the same mistake twice. After playing hundreds of games, the system only had winning choices to

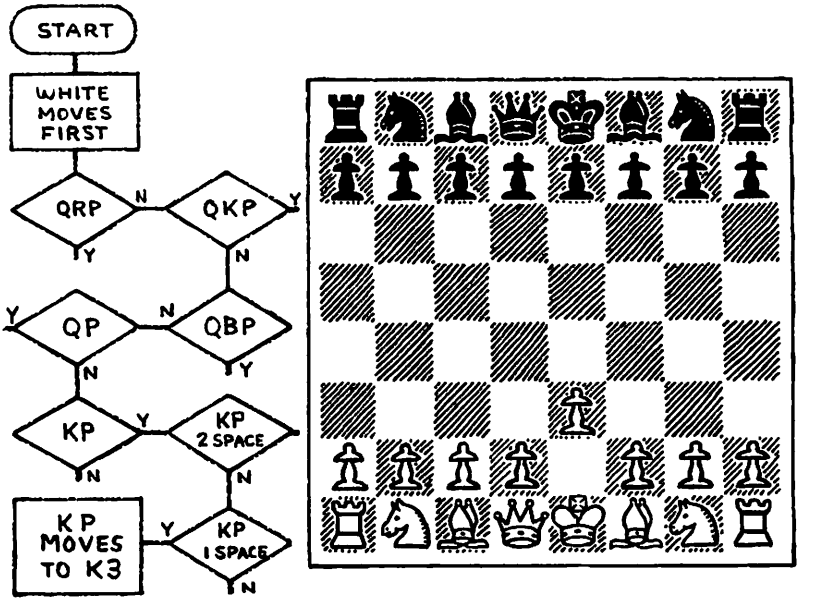


Fig. 4-1. Computer chess.

pick from. And now it was such a good player that only chess masters could beat it.

Artificial Intelligence experts have come a long way from playing games. Applications for smarter and smarter machines are appearing every day. One of the most fascinating AI areas is called robotics. If you look on General Motors' assembly line, you might be surprised to see who's manning some of the stations. Industrial robots have to be able to identify parts coming down the conveyor and select the proper tools for each task. They use television cameras to "see" and then compare the video images to ones stored in their memories to identify what they see. Then they use precision made mechanical arms to perform an often very tedious and involved process. In Fig. 4-2 computer controlled robotic painters are spraying the body and front of a GM station wagon. Another robot opens the door so that the

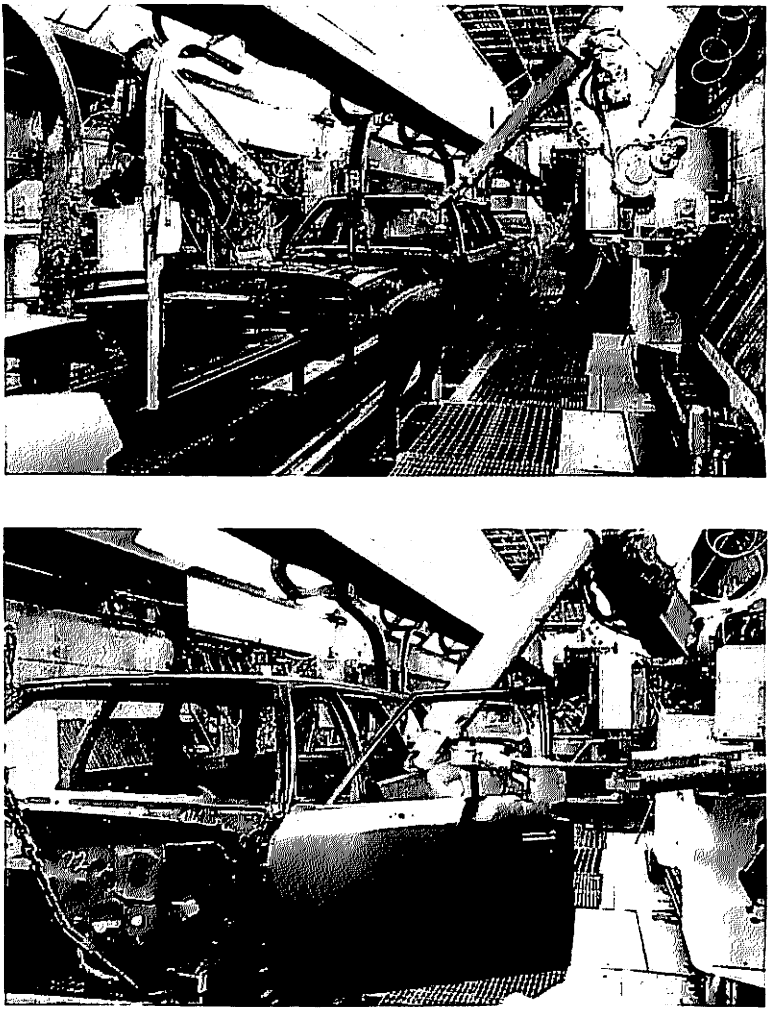


Fig. 4-2. The numerically controlled (N/C) painter is working at the GM Assembly Division.

painter can work on the inside. Fig. 4-3 shows a new model industrial robot with vision capability being developed in GM's laboratory.

Industry is not the only place smart machines are turning up. You might even run across one when you are sick. In order to give you the best treatment possible, physicians

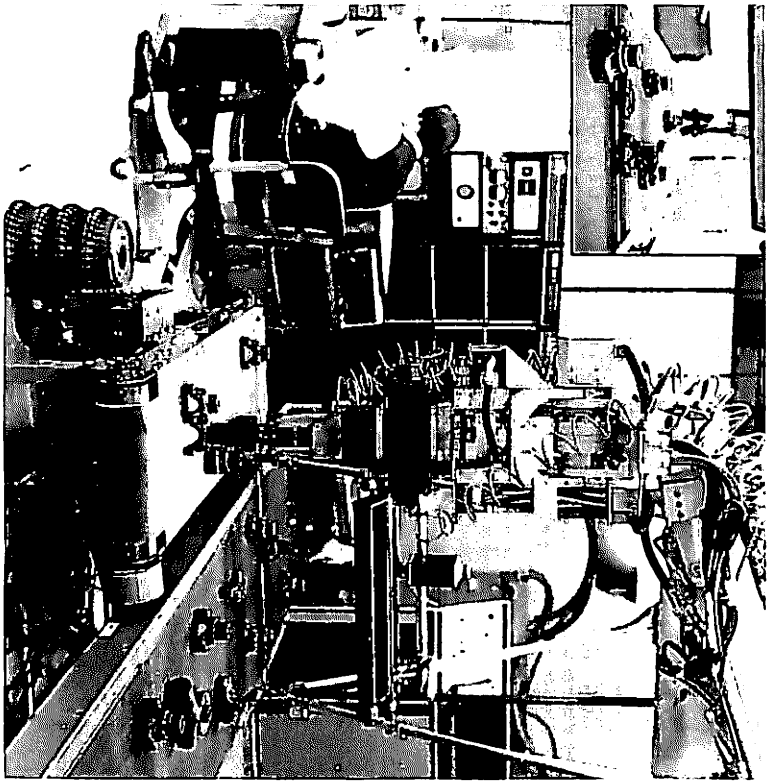


Fig. 4-3. A large industrial robot equipped with vision capability.

have to keep up with the latest medical findings. That could mean having to read and remember hundreds of articles each week. With their busy case loads, the next best thing to reading the articles themselves would be to have an assistant who could "read" and understand all the current medical information and provide it to the doctor whenever he or she needed it. So the doctors employ computers as assistants. Their office systems can tap into hospital and research data bases as well as search any on-line medical journal to find the latest words on almost any topic in their field.

As you have already learned, in a few areas, like diagnosing diseases and prescribing medication, they have found

that a computer can be a very valuable aid. Currently, physicians and computer scientists have joined together to build AI systems that prescribe the proper amount of several often used medical drugs and even does an amazingly good job of diagnosing some illnesses after "listening" to the patient's symptoms. In the future, "tell the doctor what hurts" might be replaced by "tell your symptoms to the computer."

In the years to come, Artificial Intelligence applications hold the promise of turning our sophisticated adding machines into reasoning machines that apply good ole human know-how to solving very difficult tasks. As scientists discover more about how humans think and learn, they will design their computers to be even smarter.

COMPUTERS IN THE TWENTY-FIRST CENTURY

Two hundred years ago, American frontiersmen sitting around an open fire at night would have laughed at the idea of electric lights. Yet today we take them for granted—just as we do our electric stoves, can openers, tv sets, and subway trains. If you had the chance to peek at all ways computers would be used in the years to come, you might be just as astounded as our ancestors would have been about electricity.

What will computers be doing in the 21st century? Almost everything you can imagine and probably some things that might even take today's experts by surprise. Hopefully, this glimpse into the future will spark your own interest because YOU could be the one to make these amazing things come true.

Personal computers will be very personal—you will probably wear one on your wrist like a watch. Try these scenarios for the year 2001 (Fig. 4-4).

"You are not feeling well today," your watch informs you. "You have got a 99.5°F fever, your blood-pressure is rising,

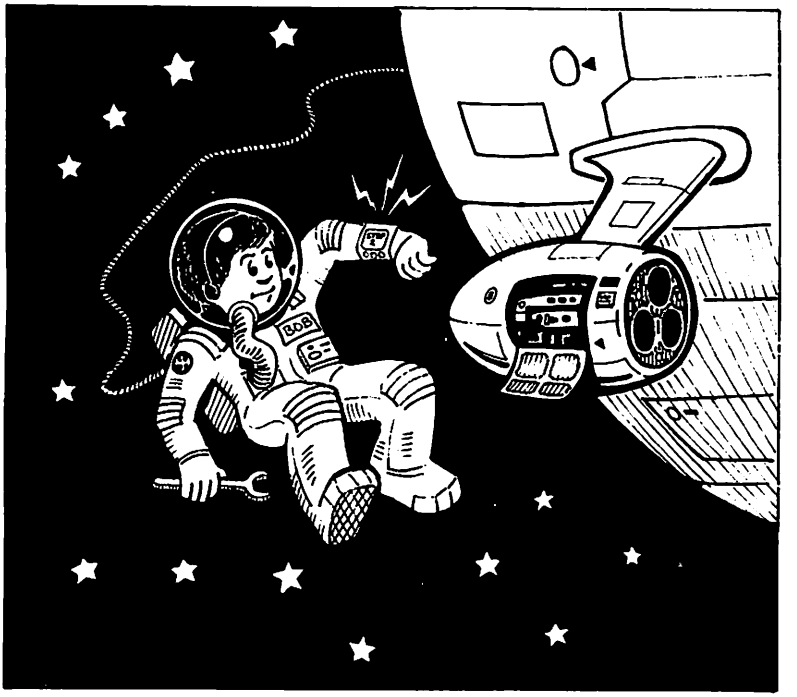


Fig. 4-4. Personal computers.

and you lost two pounds since yesterday." With insight like this, you would be better off staying in bed! The computerized wrist watch will monitor your body functions, help you solve problems, and will probably even receive television and radio signals and let you make "phone" calls.

On the job, your computerized "personal assistant" will help you remember the details of complicated procedures. Even if you are a technician aboard a space station, you will be glad to have your very own computer close at hand.

"Space station repair unit to command center," you speak into your wrist communicator. "Problem with outer vapor trifold collector."

"OK, repair unit. Prepare to receive diagnostic instructions from main system." With the touch of your finger, you have activated your portable unit. Soon you are following the step

by step pictures that show how to fix the broken collector—all while floating alongside the orbiting station in deep space.

Communication will be a big area for computers in our future. You learned in Chapter 2 that many of today's computers need special programming languages to understand what you want them to do. But tomorrow's systems will be able to understand natural languages like French, English, and Spanish. Getting them to work for you will be as easy as talking to a friend. And like a good friend, they will not hesitate to talk back. Machines with voice synthesizers that sound exactly like a person talking and that also have the ability to understand spoken commands will make you feel as comfortable working with your home computer as you are now playing a video game. Since your machine will know English and a host of other languages, it might also help you read books in languages you have never studied before or talk to someone who lives halfway around the world or even on another planet.

Walking, talking robots to rival Star Wars' best will be commonplace household servants in the not-too-distant future. With their intricate arms and visual sensors, they will be put to work doing both the time consuming and tedious tasks everybody hates. "Clean and straighten up my room," "do the laundry," and "cook dinner" might be just the commands your computerized robot is waiting to hear (Fig. 4-5).

Robots may not be the only members of your family to have a computer inside of them. Tiny computer chips will be implanted in the human body to help control artificial limbs and organs. You may have thought "the six million dollar man" was just science fiction, but there really is a field of medicine called bionics, which makes use of tiny computers to help people who have lost arms and legs to function better with their new man-made equipment. In the future, look

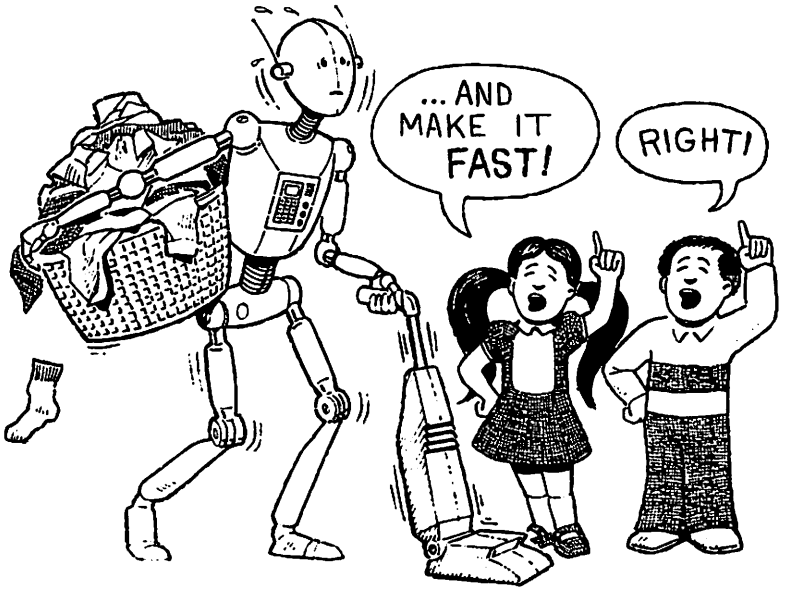


Fig. 4-5. Robot.

for computers being implanted in the eyes of the blind to help them see much like the industrial robots mentioned in the artificial intelligence chapter. A computer implant may be just as routine as a heart pacemaker implant is today. Doctors have only begun to realize the possibilities in this area. We have all got a lot to learn.

What about education in the years to come? Well, your favorite teacher may be a computer! Already personal computers are going to the head of the class in schools across the country. And you can bet that computer literacy will be as important a subject as history, geography, and language—and twice as much fun to learn. How will computer-assisted education differ from old methods? For one thing, you won't necessarily have to go to school to learn a new lesson. You

might just spend an hour with your home computer instead. It could take you through dozens of math exercises (and even make them fun), carry on a conversation with you in French, or show you a movie on sending rockets to outer space.

Researching the Mayan civilization for a term paper might only take a few minutes because you will have whole libraries of information right in your own home on tiny computer chips no bigger than your fingernail. Imagine a set of encyclopedias, maps, catalogs, telephone directories, and more that could all fit into a matchbox. And, of course, your home computer will help you harness the power of all that information by making it easily available when you need it (Fig. 4-6).

If you make your spare spending money delivering papers, you will probably be out of a job in another 50 years. Most information will be delivered electronically by computers

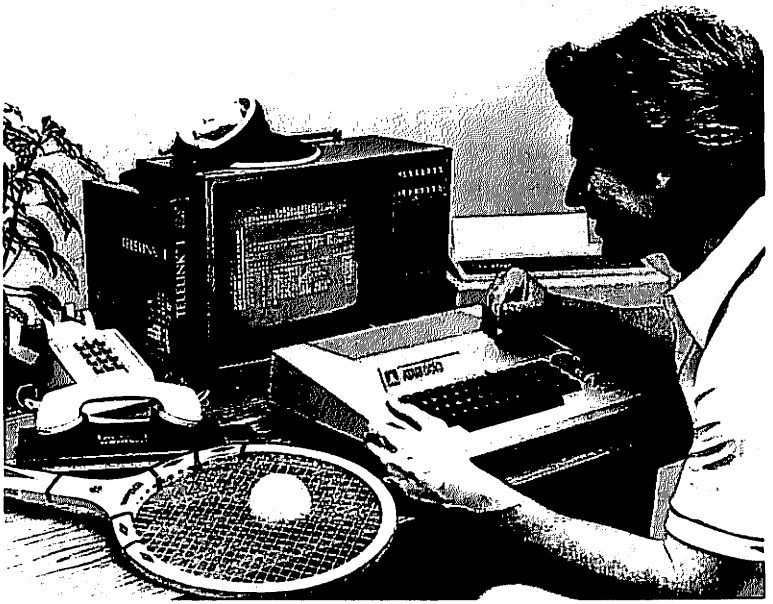
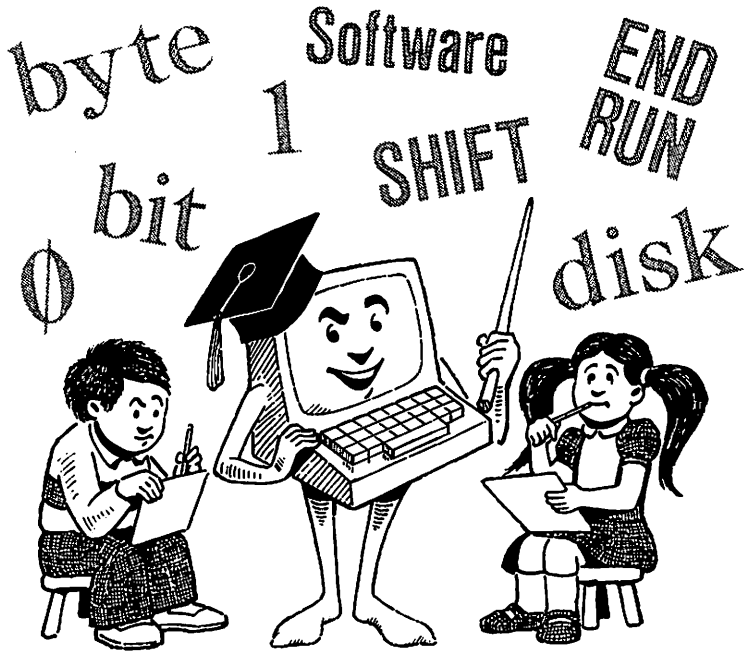


Fig. 4-6. A home computer system. *(Courtesy Atari, Inc.)*

instead of on paper you can hold in your hand. Newspapers, magazines, stock market quotations, airplane schedules, and business correspondence are often prepared using computers today. As more and more people and businesses buy their own systems, we will see great increases in the amount of information delivered by "electronic mail"—computer to computer. One of the best advantages of having your mail delivered this way is that the computer can file it for you and retrieve it when you need it. Sending mail electronically is faster than using the postal service and is often cheaper than printing out thousands and thousands of copies. And your house won't be cluttered with all that paper!

In addition to keeping track of our information, computers of tomorrow will also help us get where we are going. Whether we are heading to grandma's house or to the moon, our transportation systems will know the way and take us there in the shortest time and in the safest way possible. Built-in maps of your home town, state, country, and galaxy will guide your programmed vehicle along highways or flight paths to your destination. On-board sensors will keep a sharp eye out for approaching objects and avoid collisions. You may not even have to steer at all! And when the family transportation breaks down, its computer will tell you what is wrong and may even help it to repair itself.

Computers in the 21st century will enrich our world. They will help doctors find answers to questions about some of life's most threatening diseases as well as help scientists learn more about life itself. They will be used to conserve our natural resources and to learn more about our environment and our universe. Computers will be there helping us solve today's problems and daring us to meet tomorrow's challenges.



5 Test Your Computer IQ

Now that you have done some reading about how computers work and you have seen some of the many ways that these smart machines can be used, it is time for you to test your knowledge. We have put together a selection of games about computers that you don't need to be near a terminal to play.

Good luck! You will find the answers in Appendix A.

Chart 5-1. Play Tic Tac Toe To Test Your Computer IQ

The computer usually takes a thousand seconds to add two numbers T / F	A binary code uses the numbers 1 and 2 T / F	A telephone is an example of a data base T / F
The computer's memory can store millions of bits of information numbers T / F	The heart of the modern computer is a silicon chip T / F	A tv screen is often used for computer output T / F
The software is the part of the computer that is soft to the touch T / F	The parts of the computer that you can see and touch are called the hardware T / F	Computer chips are also used in baking chocolate chip cookies T / F

Scoring: Decide whether the statement in each square is true or false. Then check your answers against the right ones in Appendix A. For each correct answer, mark that square with an "O." For each wrong answer, mark that square with a "X." To find out if you have won, count the number of squares marked with Os and the number marked with Xs. Your score is the number of squares marked with Os and the highest score wins (Q5-1).

BREAK THE CODE

Try your hand at solving the following riddles using the binary code provided. The answers can be found in Appendix A (Q5-2).

Code

A= 0000	N= 1000
B= 0001	O= 1001
E= 0010	R= 1011
F= 0011	S= 1100
G= 0100	T= 1101
H= 0101	U= 1110
I= 0110	V= 1111
L= 0111	W= 01111

1. Q. Why is a computer like an elephant?
   A. Because

0001 1001 1101 0101 1000 0010 1111 0010 1011

0011 1001 1011 0100 0010 1101

2. Q. Why did the computer operator tear the input cards into tiny pieces?
   A. Because he thought that the computer needed to get all its information

0110 1000 0111 0110 1101 1101 0111 0010

0001 0110 1101 1100

3. Q. Why did the man spray insecticide all over his wife's computer terminal?
   A. Because she kept complaining that her programs were

0011 1110 0111 0111 1001 0011 0001 1110 0100 1100

4. Q. Why did the kid soak his computer terminal in fabric softener?

A. Because he wanted to make

0110 1101 0110 1000 1101 1001

1100 1001 0011 1101 01111 0000 1011 0010

JUMBLE

Unscramble the following computer words and place the numbered letters in the appropriate spaces to answer the riddle. The answer can be found in Appendix A (Q5-3).

SACBI _____ _____ _____ _____ _____
7

TPUOTU _____ _____ _____ _____ _____ _____
10 1 8

AATD _____ _____ _____ _____
4

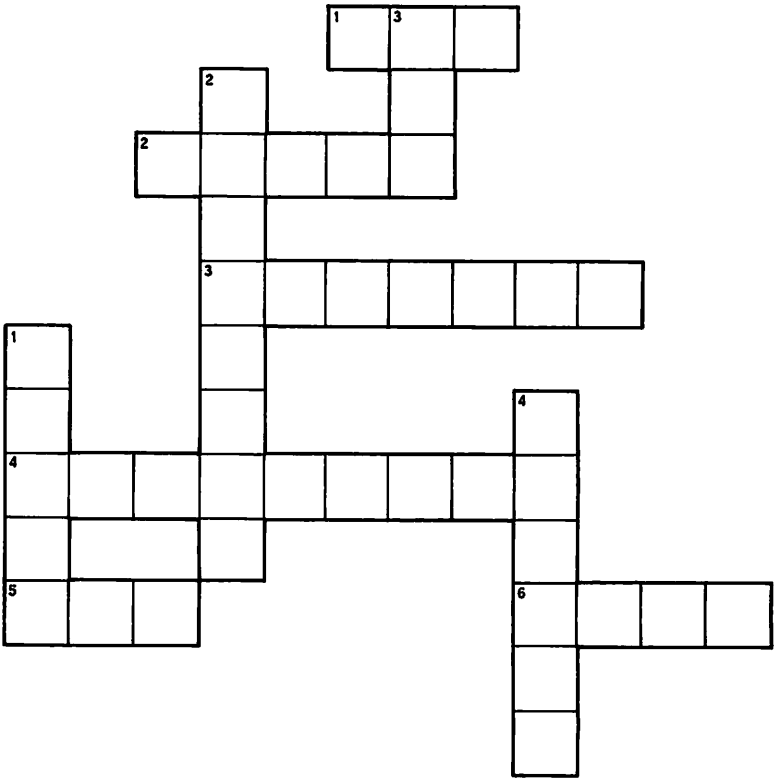
EMOYMR _____ _____ _____ _____ _____ _____
3 2 9

YKES _____ _____ _____ _____
5

INEL _____ _____ _____ _____
11 6

Q. Why did the boy put sneakers on his computer program?
A. Because he wanted

_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
1 2 3 4 5 6 7 8 9 10 11



COMPUTER CROSSWORD

The answers can be found in Appendix A (Q5-4).

Down

1. A simple language that a lot of computers use is called _____.
2. It thinks faster than a speeding bullet. It's a _____ _____.
3. The _____ code on a package of food is scanned by supermarket computers to identify the food and its price.

4. The place where the computer stores its instructions and other information _____.

Across

1. A mistake in a computer program that keeps it from working correctly _____.
2. A computer makes a decision based on _____.
3. A detailed set of instructions that a computer uses to do its job is called a _____.
4. A computerized weather _____ takes pictures of the earth from thousands of miles away.
5. The work horse of the computer system is the _____.
6. A cook might use the computer in her _____ to cook a meal while she is away from home.

WORD FIND

In the near future we will see more computers around the house. See how many of the 27 computer applications listed below you can find in the puzzle.

The answers to word find can be found in Appendix A (Q5-5).

BOOKS	FIRE ALARM	TELEPHONE
BURGLAR ALARM	IRON	TELEVISION
CALCULATOR	LIGHTS	THERMOSTAT
CAMERA	MAIL	TOYS
CAR	MICROWAVE OVEN	VACUUM
CLOCK	NEWSPAPER	VCR
DICTIONARY	REFRIGERATOR	VIDEO GAMES
DISHWASHER	SCALE	WASHER
DOORBELL	STEREO	WATCH

B D D W A G A E E L L E B R O O D C A C A
S R C V G Z M M R A L A E R I F I O W A M
E T E L E P H O N E C G A E O W S T I L R
M H S F S T H G I L I A M P Z A H N R C A
A E R A R W A S H E R C U A F F W N O U L
G R B E B I S L N C J R U P K F A A N L A
O M S U V C G H O N A N C S S O S E F A R
E O B C H A T E E C O U A W Y C H V R T A
D S E C U M I C R O W A V E O V E N K O L
I T T P Z E V U E A E N A N T W R U C R G
V A R N V R S A T O T E L E V I S I O N R
W T R R A A T T S K O O B E R A L T L V U
H A U T D I C T I O N A R Y B E L A C S B

QUESTIONS FOR TEACHER'S GRADE BOOK GAME

In this game you will use a DATA BASE to answer eight questions about the students in Mrs. Wolf's third grade class. In order to begin playing the game you must figure out which student's name answers the first question and place that name in the *answer space*. Then take the First Letter of the student's name and write it into block 1 in the *secret word space*.

For the second question, you will place the first letter of your answer into block 2 of the *secret word space*. You continue in this way for each of the other 6 questions.

When you finish the quiz you will be able to read the secret word. We have done question No. 3 for you, just to get you started.

answer space

1. The student who received a math award _____
2. The student with the lowest test scores on both tests _____

CAROL

3. A student who never missed class _____
4. A student who probably fights in class _____
5. A 9 year old student with poor grades _____
6. A male student with few absences _____
7. The probable winner of the spelling bee _____
8. A boy who probably skipped a grade _____

Hidden Word

Kids are always happy when this begins

		C					
1	2	3	4	5	6	7	8

(Q5-6)

Class 3-3 Teacher Mrs. Wolf

Student	Age	Math Test	Spelling Test	Days Absent	Behavior
Ann	8	65	60	7	B
Alice	8	85	70	15	D
Bob	8	80	90	2	A
Carole	8	85	95	0	B
David	8	85	75	3	C
Ira	8	90	80	1	C
Jennifer	9	80	82	3	A
Maya	9	85	85	8	A
Nick	7	95	85	2	B
Olivia	8	70	100	5	A
Tony	9	65	75	4	C
Victor	8	100	90	2	B

FIND THE BUG

There are one or more bugs in the following programs. See if you can find and correct them. If you have a computer, try running your corrected version.

Program 1: A Teacher's Helper

Assign a letter grade to each spelling test score.

```
10 INPUT "TYPE IN SPELLING TEST SCORE"; A
20 IF A >= 90 THEN PRINT "GRADE IS A"
30 IF A < 90 AND A >=80 THEN PRINT "GRADE IS B."
40 IF A < 80 AND A >=70 THEN PRINT "GRADE IS C."
50 IF A < 70 THEN PRINT "GRADE IS A+."
60 END
```

Check your answer in Appendix A (Q5-7). Hint: If you are not a great speller, you might prefer to give the program to your teacher with one of the bugs still in it!

Program 2: Saving for Something Big

Find out how long you will have to save your allowance to buy that special toy you have seen on tv. Assume that you get your allowance at the end of the week.

```
10 INPUT "TYPE WEEKLY ALLOWANCE"; A
20 INPUT "TYPE COST OF TOY"; B
30 IF A >= B THEN GOTO 60
40 C = B/A
50 IF C * A < B THEN C = C + 1
60 IF A >= B THEN C = 0
70 PRINT C "WEEKS"
80 END
```

Check your answer in Appendix A (Q5-8). Line 50 is testing for a remainder to see whether you will have to save for a part of a week to have enough money. HINT: What happens if your allowance is enough to cover the cost of the toy? You

will still have to wait until the end of the week to have the money to spend.

COMPUTER SCRAPBOOK RALLY

Some kids collect stamps and baseball cards. But here is a greater challenge for you: Be the first one on the block to have your very own computer scrapbook! In this section, see how many items you can find that are either produced by a computer or about computers. You can enter the rally on your own, with a friend, or as a class project. If you want this activity to be competitive, scoring can be based on how well you do. Save your collection in a scrapbook and be sure to label each entry. *RULES:* The rally is divided into three categories: novice, apprentice, and expert. The novice items will probably be easiest to find. With the apprentice list, you will have to look a little harder to complete your collection. And if you get most of the expert collection, you are well on your way to having a high computer IQ. *SCORING:* You get one point for each item collected in the novice class, two points for each apprentice class item, and three points for each expert item collected. *Remember, each item has to be generated by a computer or be about computers to count.* You get a five point bonus for each program you have written.

Novice

- UPC bar code
- Form letter (you get an extra point if the computer spelled your name right.)
- Report card
- Computer cash register receipt
- Bar-coded library card
- Computer mailing label
- Newspaper ad for a home computer

Apprentice

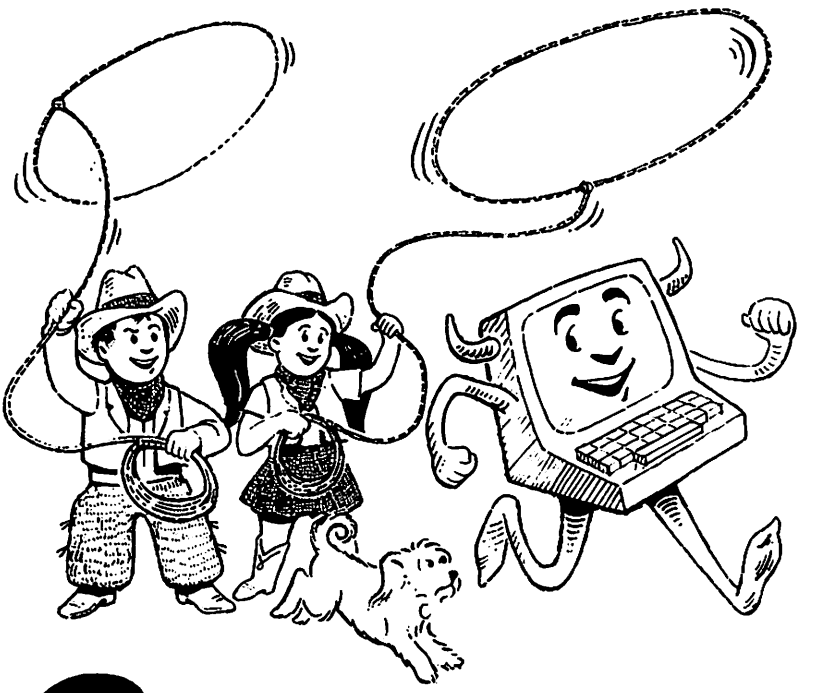
- Baseball/basketball/football ticket
- Train/metro fare card
- Bank statement
- Credit card bill
- Answer sheet for a machine graded test
- Advertisement for a new appliance that has a computer inside of it
- Biorhythm chart

Expert

- Program listing
- Computer generated prescription envelope
- Car diagnostic printout
- Picture done on a computer (you get an extra point if it's a picture of you)
- A programming book (you get three points for each book that you own or have read since the rally started)
- Music generated by a computer
- Recording of a computer generated voice
- Receipt from a 24-hour banking machine
- Printout of information from a commercial data base such as THE SOURCE

Bonus

- Programs you have written



6 Hands-On Activities

Now that you know how computers work and how they are being used, you are probably eager to try one out yourself. It's time to do just that. This chapter has sections for eight of the most popular home computers.

When you first start on a new computer, you will soon discover that some systems are easier to learn than others. Computers and programs that are easy to learn, give clear instructions, and are helpful when you make a mistake or don't know what to do next are called user friendly. For example, if you misspell the word "PRINT" as "PRIMT", a user friendly BASIC program might tell you to "check your

typing in line 10," where an unfriendly one might just say "ERROR." The following are helpful hints to help you when you are having trouble getting a program to work.

1. First try checking your typing. Remember that 1 (the number one) and l (the lower-case letter L) cannot be interchanged and 0 (zero) and O (the letter O) are also different keys.
2. Are you typing in capital letters? Many programs (even BASIC on some home computers) will only understand your instructions if they are typed in capital letters.
3. Look in your user's handbook for the specific guides for running the program or the correct format for a BASIC statement. Sometimes programs are fussy about punctuation and spaces being in the right places. Check all punctuation in your typing to make sure it matches what is in the program.
4. Don't be shy about asking for help from somebody who knows how the program works. Your parents, teachers, friends, or even your neighborhood computer store person are good people to turn to when you are really stuck.

If your computer is not included in this section, you can still do the hands-on activities. Your user's reference guide will tell you how to move the cursor and clear the screen. The BASIC program for filling the screen with your name should work on most home computers. The graphics, color, and music programs will vary with each system. The best way to do these is to look in the guide's index under COLOR, GRAPHICS, and SOUND or MUSIC entries. Then substitute the way your computer wants to see these instructions for the statements in the programs in this book.

Activities presented in Chapter 6 should be easy and fun and give you a good idea of the neat things your home computer can do. We hope they will encourage you to try variations of these and other programs on your own.

1. Get your parents to hook up the computer.
2. Find the black on-off switch on the back side of the computer next to the place where the power cord plugs in.
   a. Push the on-off switch to the upward position.
3. Now look at the keyboard (see Fig. 6-1).
   a. The "POWER" light on the lower left hand corner of the keyboard will come on.
   b. If you don't have a disk drive, your screen should look something like this.

```
APPLE][

]■
```

   c. If you do have a disk drive your screen will look like this.

```
APPLE][
```

   d. Press the RESET button on the upper right hand side of the keyboard. Now the screen will look like this.

```
]■
```

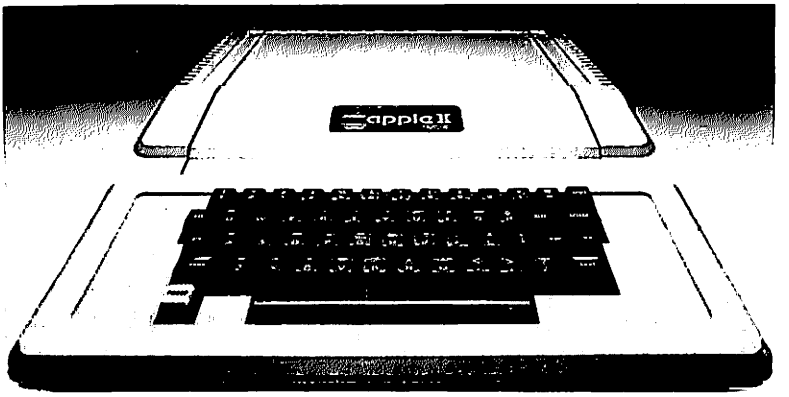


Fig. 6-1. Keyboard of the Apple II Plus computer.
(Courtesy Apple Computer, Inc.)

4. Notice the blinking green box on the screen. This is the cursor. The cursor is the computer's special mark that tells you where the next character that you press will appear on the screen.
5. Now find the ESC key and press it. Then press SHIFT and @/P at the same time this will move your cursor to the top left hand corner of the screen, the Home.

Clearing the Screen

1. Type the following letters on your keyboard

SMILE

   a. The word will appear on your screen.
2. Now find the SHIFT keys located on either side of the keyboard.
3. Also find the ESC key on the left hand side of the @/P key on the right hand side.
4. Press the ESC key and release it. Now hold down either SHIFT key and press the @/P key AT THE SAME TIME.

Presto! You have cleared the screen. All that is left is the cursor.
Hint: If you ever have trouble getting the computer to obey you, repeat step 4 and try again.

Moving the Cursor

1. You can even move the cursor around the screen.
2. First press and release the ESC key. This puts the machine into edit mode.
3. Now press the M key.
   a. Notice how the cursor moves down the screen.

4. Next press the I key.
   a. This will move the cursor up the screen.
5. Find the J key. It moves the cursor to the right. The K key moves the cursor to the left.
   a. Try using these keys to move the cursor around the screen.
6. Next hold down the K key and the REPT key AT THE SAME TIME.
   a. The cursor will zip around the screen disappearing off the screen as it reaches the right edge and reappearing on the left side.
7. You can press the REPT key with any of the cursor movement keys, whenever you want to make the cursor move quickly.
   a. Try pressing the REPT key and the I key.
   b. What happens?
8. All done moving the cursor?
   a. Then press the space bar once. This will put you back into normal mode.
9. You can also move the cursor in normal mode.
   a. The ◖ key will move the cursor one space to the left.
   b. The ◗ key will move the cursor one space to the right.

Hint: If you move the cursor over the last letter you typed and press the long space bar at the bottom of the keyboard, that letter will vanish from the screen. (We will tell you more about editing shortly.)

The Screen—How Big Is It?

1. Move the cursor back to the top of the screen by pressing ESC and then SHIFT and @/P at the same time.

2. Find the letter @/P and type it across the screen.
   a. How many letters have you typed? You should get 40. This is the number of columns on your APPLE II.
3. Now hit your letter again. NEXT hit the ESC key, then hit the long space bar, then hit @/P. Keep repeating this process until you get down to the bottom of the screen.

   Hint: If the top row of Ps disappears from the screen it means that you are ready to count.

4. Count all the letters going down. You should get 24. This is the number of rows on your APPLE II.

Q. If you filled the screen with letters, how many letters would you have? (Hint: Multiply the number of rows by the number of columns.)
A. The answer is 960.

Correcting an Error

1. Clear your screen by pressing and releasing the ESC key. Then pressing the SHIFT key and the @/P key AT THE SAME TIME.
2. Type your name and make an error by adding an extra E on the end. To correct the error:
   a. Press the ← key. The cursor will move one space to the left, on top of the extra E. This erases the E.
   b. Press the space bar. The computer will show your name without the E.
3. If you want to CHANGE the E to an S instead of erasing it.
   a. Move the cursor over the E using the ← key as you did before.
   b. Now type S.
   c. The computer will print your name with an S on the end.

For example, you clear the screen.
Now you type

DAVIDE

Move the cursor here and type S.
The computer will show

DAVIDS.

4. If you want to change a letter in the middle of a word.
   a. Press the ◆ key until the cursor is on top of the letter you want to change and type a new letter!

For example, you clear the screen.
Then type

DARID

Move the cursor here and type V.

   b. Next press ◆. This will move the cursor one space to the right. Keep pressing until the cursor is just to the right of the last letter of your name.
5. If you want to add a letter to the middle of a word.
   a. Press the ◆ to the spot where you want to add the letter.
   b. Type your extra letter and then RETYPE the rest of the word.

For example, you type DAID

Move the cursor here and type VID.
The computer will show DAVID.

Disks and Tapes

Your Apple comes with some neat disks or tapes that have game programs on them. Before you begin playing you need to learn how to load your disk or tape.

Loading a Disk Drive

1. Flip up the little black door on the disk drive.
2. Get the SYSTEM MASTER diskette from its package.
   a. Hold the disk with the label FACING UP and the oval cutout on the part of the disk facing away from you (Fig. 6-2).
3. Slide the disk into the slot on the disk drive and close the door.
4. After your disk is loaded you will want to put the Disk Operating System (DOS) into action (a process called booting DOS).
   a. This system will allow you to save and call up programs that you might want to write.
5. To boot DOS just turn off your computer. Now turn it on again.
   a. The disk drive will make a noise.
   b. The disk drive's red in use light will come on.
6. Wait until the noise stops and the light goes out.
   a. Your screen will look something like this

```
DOS VERSION 3.3
8/1/84
APPLE II PLUS or ROMCARD
SYSTEM MASTER
```

Loading Tapes

1. Press the rewind button and rewind the tape.
2. Start playing the tape. Type LOAD and press RETURN .
   a. In a few seconds the Apple will beep. This means

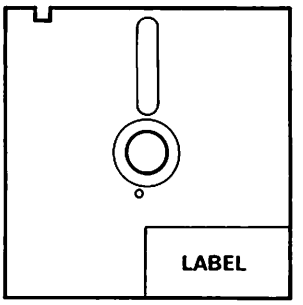


Fig. 6-2. Sketch of computer disk.

that the tape's information is going into the computer.

b. After a little while the Apple will beep again. This means the tape is loaded.

3. Stop the tape recorder. Rewind the tape.
4. Type RUN and press RETURN .

The Program

Now, you are ready to try some of the programs on your system master.

1. Just type CATALOG and press the RETURN key.

Look! A list of filenames has appeared on your screen. You can easily run one of these special files. For example, if you want to play LITTLE BRICK OUT.

1. First make sure that your parents have hooked the game paddles up to the computer.
2. Now you type RUN LITTLE BRICK OUT and press RETURN .
   a. Instructions for running the game will appear on your screen.

Want to find out about Apple's color graphics? Just type:

1. CATALOG and RETURN again.
2. Next type RUN COLOR DEMOSOFT.
   a. Instructions for running this file will appear on your screen as well.

All done? Press ESC .

Fill in the Screen With Your Name

1. Clear the screen, by pressing ESC and then SHIFT and @/P at the same time.
2. Type NEW and press the RETURN key.
3. Type 1 SPACE (press the space bar once) PRINT SPACE. Then type " (press SHIFT and "/ at the same time). Next type in your name.
4. Now type " and ; (the +/; key) then press RETURN .
5. Type 2 SPACE GOTO SPACE 1 and press RETURN .

Your program will look like this:

```
1 PRINT "JENNY";
2 GOTO 1
```

6. Now type RUN and press RETURN . Your screen will start filling with your name.
7. Press RESET to stop the program.
   If you make a mistake or just want to change a line in the program you can type LIST and press RETURN .
   a. Then you can correct or change the line by simply retyping it.

   For example, you typed

   ```
   1 PRINT "JENNY";
   ```

   and you want to change the name to MAYA. You retype the line correctly and press RETURN . Now you can run your corrected program.

1. If you are using an Apple IIe, most of the hands-on activities for the Apple II plus will work just fine. However, your computer has some additional features and keys that make cursor movement easier. See Fig. 6-3. The left arrow key backs up the cursor and the right arrow moves the cursor to the right. The best way to get to know your Apple IIe keyboard is to go through the Introduction to the Apple IIe Computer program that comes with your system. Just load that disk and turn your computer on. It's an excellent introduction.
2. Now try the hands-on activities for the Apple II in the previous section. If you have an 80 column display, the number of characters across the screen will be 80 instead of 40.

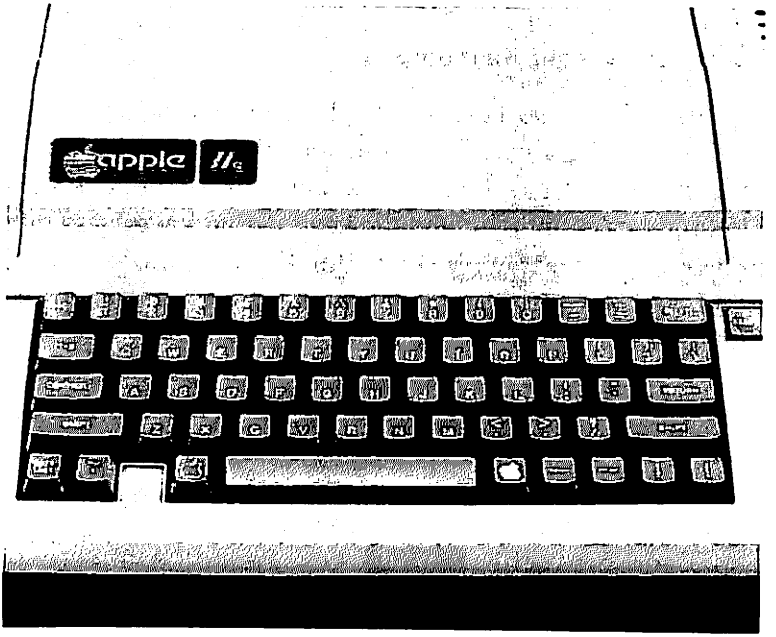


Fig. 6-3. Keyboard of the Apple IIe computer.
(Courtesy Apple Computer, Inc.)

1. Get your parents to show you how to hook up the computer to your television. After that is done, then turn on the tv and let it warm up a few seconds.
2. Close the cartridge door on the top of the console and you are ready to turn your ATARI 800 on. The power on/off switch is on the right side panel of the computer. Go ahead and move the switch to the ON position. Your screen should look like this:

ATARI COMPUTER - MEMO PAD

3. The white square you see on the screen under the A is called the cursor. The cursor is the computer's special mark that tells you where the next character that you type will appear on the screen.

Introducing Your Keyboard

The ATARI 800 keyboard looks a lot like a regular typewriter (see Fig.6-4). It has the letters of the alphabet and the numbers 0–9, as well as punctuation marks. The letters print in upper case until you put the keyboard in lower case mode by using the LOWR key. But there is more you can do from your keyboard than just enter numbers and letters. Three special keys, the ESC (escape key), the ATARI logo key, and the CTRL (control key) are used together with other keys for graphics, inverse video, and screen editing.

1. Clearing the screen: Hold down the CTRL key and press the CLEAR key. Presto! Your screen is clear of everything except the cursor.
2. Moving the cursor: The CTRL key together with the four keys with arrows pointing up, down, left, and right

Fig. 6-4. Keyboard of ATARI 800 computer. *(Courtesy Atari, Inc.)*

(on the same keys as the −, =, +, and *) is used to move the cursor around the screen.

CTRL and − moves the cursor up one line.
CTRL and = moves the cursor down one line.
CTRL and * moves the cursor one space to the right.
CTRL and + moves the cursor one space to the left.

The Screen—How Big Is It?

1. Clear the screen using CTRL and CLEAR. Make sure that the cursor is in the HOME position (upper left corner). Now find the letter P and type it across the screen. How many Ps have you typed? You should get 38. This is the number of columns on your ATARI 800 display. The screen on the ATARI actually has 40 columns, but the first and second columns can only be used for printing with a position statement (from a BASIC program). From the keyboard, you can only type 38 characters across.
2. Hit the letter again and a P should appear on the sec-

ond line. The ATARI keyboard has a wrap-around feature that does an automatic return at the end of a line. Also if you hold a key down for more than one-half second, the system will repeat that key for you. Now press RETURN and type another P on the next line. Keep doing this until you have typed a P on the last line on the screen. Count the number of Ps down the left side of your display. You should get 24. This is the number of rows your ATARI 800 can display on its screen.

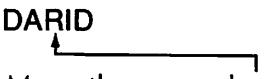
3. If you filled the screen with letters, how many would you have to type? (Hint: Multiply the number of rows by the number of columns.) Did you get 912?
4. If you press RETURN on the last row, everything on the screen will move up a row. This is called *scrolling*.

Correcting an Error

1. It's easy to make mistakes when typing a program especially if you are a beginner. So it's very important that you know how to correct those kinds of errors. The ATARI uses the CTRL key held down at the same time with other keys to stand for editing operations such as inserting and deleting characters.
2. Type your name but make an error by adding an extra E on the end. To fix the mistake, move the cursor just to the right of the E. Then press the DELETE/BACK S key. This moves the cursor back one space and erases the letter E. Another way to delete a character is by positioning the cursor on top of the letter you want to erase (using cursor keys) and pressing CTRL and DELETE. This will get rid of that one character.

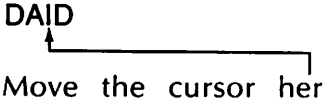
DAVIDE
↑
Move the cursor here and press the CTRL and DELETE keys.

3. If you want to change a letter in a word, just move the cursor on top of the letter you want to change and type the new letter.



Move the cursor here and type v.

4. If you want to add a letter to a word, move the cursor over the character immediately to the right of the place where you want to put the new character. Press CTRL and INSERT. This will open up a space where you can put the character you want to add.



Move the cursor here and press CTRL and INSERT at the same time. Type a v in the space that was opened up for you.

Getting Down to Basics

Insert your ATARI BASIC cartridge into the left slot on top of the computer. If you are just turning your system ON, then BASIC will come up first instead of the MEMO PAD mode. If you have been experimenting with the keyboard, just load the cartridge and press START. If the BASIC cartridge is in, it always comes up "READY" without pressing anything. When there's no cartridge loaded, turning your system *ON* will give you MEMO PAD. If you exit BASIC with a "BYE" command, you will be put into MEMO PAD. And to go back into BASIC, just press SYSTEM RESET.

Filling the Screen With Your Name

1. Type NEW and press RETURN.
2. Type in these lines but put in your name instead of JENNY.

Also press RETURN at the end of each line. RETURN tells your computer to put this instruction in its memory.

```
10 PRINT "JENNY ";
20 GO TO 10
30 END
```

3. Now type RUN. Your name should fill up the screen. To stop this program press BREAK. This will stop the program, print a "STOPPED AT LINE 10" message on your screen, and return the cursor so you can enter another command.

Fun With Color

The ATARI 800 lets you change colors of characters and symbols by using the COLOR statement. Of course, this only works if your system is using a color tv or monitor. Try running this program and see what happens. Remember to type return at the end of each line.

```
CTRL/CLEAR
NEW
10 GRAPHICS 2
20 SETCOLOR 4,13,0
30 SETCOLOR 0,13,6
40 POSITION 7,2
50 PRINT 6; "RAY"
RUN
```

This program changes the background to dark green and prints RAY in light green. You can change the colors by putting in different numbers in the SETCOLOR statement. The list of possible colors is in your ATARI 800 BASIC reference.

Press SYSTEM RESET to clear the screen. Your program won't be erased until you type NEW and press RETURN .

Sounds Nice

The ATARI 800 can also generate musical notes and sounds through the audio part of your tv. Listen to what this program sounds like.

```
NEW
10 FOR J=1 TO 100
20 SOUND 0,RND(0)*255,10,10
30 SOUND NEXT J
40 END
RUN
```

This program will produce 100 random sounds. If you press BREAK before it's finished, a tone will sound until you type in SOUND 1,0,0,0 and press RETURN . The second number in the SOUND statement tells the computer what note to play. The RND(0)*255 produces a random number between 0 and 255. The numbers for some of the notes can be found in the ATARI BASIC reference manual. The loudness of the sound can be changed by putting in a different number for the last 10 in the list for the SOUND statement. One is the softest and a 15 is the loudest.

COMMODORE 64™ HANDS-ON ACTIVITIES

1. Get your parents or teacher to hook up the computer or show you how this is done.

Introducing the Keyboard

2. The Commodore 64 computer keyboard looks a lot like a typewriter (see Fig.6-5). It has letters, numbers, and punctuation. It also has some special keys that will

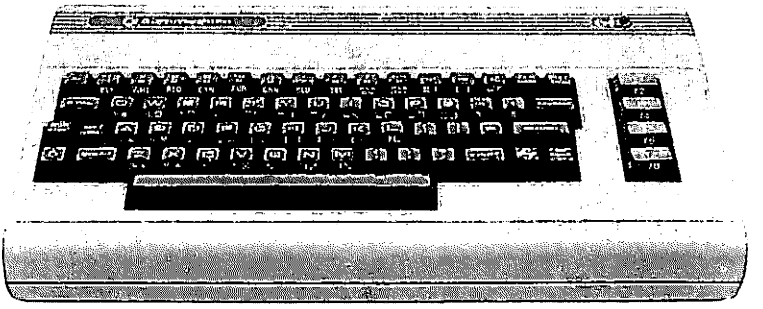


Fig. 6-5. Keyboard of the Commodore 64 computer.
(Courtesy Commodore Business Machines, Inc.)

be introduced in this section. The letters can print in upper or lower case depending upon the mode that you have selected. The Commodore 64's keyboard also looks very similar to the VIC 20 console. They are made by the same company.

3. Turn on the tv. Now find the on/off power switch on the right side panel of the computer and flip it to the ON position. Your screen should look like this:

```
****COMMODORE 64 BASIC V2****

64K RAM SYSTEM 38911 BASIC BYTES FREE

READY
```

4. Notice the blinking light blue box under the READY. This is the CURSOR, the computer's special mark that shows you where the next character that you press will appear on the screen.

Clearing the Screen

1. Find the CLR/HOME button and press it. This will send the cursor to the top left hand corner of the screen or HOME position.

2. If you press the SHIFT key (located on the bottom row on either side of the keyboard) and the CLR/HOME button at the same time you clear the screen and send the cursor to HOME.

Moving the Cursor

1. You can move the cursor around the screen with the cursor control keys that look like this: ◆ CRSR ◆ ◆ CRSR ◆
2. The CRSR with the up and down arrows moves the blinking box either up or down the screen. If you press the CRSR key by itself, the cursor will move down. If you press the SHIFT key and the CRSR, the cursor will move up.
3. The CRSR with the left and right arrows moves the blinking square either to the left or right. If you press it by itself, the cursor will move to the right. Together with the SHIFT key, the CRSR will move it to the left.
4. Here is a neat trick. Clear the screen. Now hold down the CRSR key and watch as the little box scurries across the screen and keeps circling moving downward everytime it finishes a lap.

The Screen—How Big Is It?

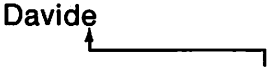
1. Find the letter P and type it across the screen. How many Ps have you typed? You should get 40. This is the number of columns on your Commodore 64.
2. Now type Ps all the way down the left side of the screen. You can use the cursor movement keys or the RETURN button to get to the next line. The RETURN key tells the computer to look at what you typed and put it into memory for later use. It does not matter in this case, but in BASIC programming you will want the computer to save your input for you. Now count the number of Ps down the side of your screen.

You should get 25. That is the number of rows on your Commodore 64's display.

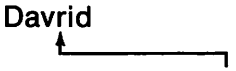
3. If you filled the screen with letters, how many would you have to type? (Hint: Multiply the number of rows by the number of columns.) Did you get 1000 for your answer?

Correcting an Error

1. Clear the screen by pressing SHIFT and CLR/HOME at the same time.
2. Type your name and make a goof by adding an extra E on the screen.
3. Move the cursor one character to the right of the mistake you want to erase. Then press INST/DEL key. The cursor will back up a space, erasing the previous character. If you are in the middle of a line, all the characters to the right of the cursor will move over one space to the left, too.

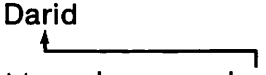


Move the cursor here and press INST/DEL.



Move the cursor here and press INST/DEL.

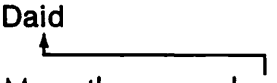
4. If you want to change a letter in a word, just move the cursor on top of that letter and type over it. Your new letter will replace the mistake.



Move the cursor here and type v.

5. Here is how you add a letter to a word. Move the cursor over the letter that will be right after the letter that

you want to add. Press SHIFT and INST/DEL and a space will be inserted. Now type in the letter you wanted to add.



Move the cursor here. Press SHIFT and INST/DEL at the same time. Now type the letter v. The line will now show David spelled right.

Getting Down to Basics

Your Commodore 64 can do lots of neat things using color, graphics, and sound. There are commands in BASIC that allow you to tell the system when and how to use these features. Here are a few simple programs for you to try.

Filling the Screen With Your Name

1. Clear the screen by holding the SHIFT and the CLR/HOME keys at the same time. Type NEW and press RETURN. Remember to press RETURN after each line of the program. Now type in the following lines but substitute your name for JENNY.

```
NEW
10 PRINT "JENNY ";
20 GO TO 10
30 END
```

   Now type RUN and your screen will fill with your name. Press the RUN/STOP key to stop the program.

2. If you would like to fill the screen with your name in different colors, try this program. Type in your name where it says YOUR NAME and press RETURN after

each line. You tell the computer to change colors by pressing CTRL and one of number keys 1 – 8. The color that each represents is abbreviated on the front of the key. 1 is black, 2 is white, 3 is red, etc.

```
NEW
10 PRINT "CTRL/RED YOUR NAME";
20 PRINT "CTRL/BLU YOUR NAME";
30 PRINT "CTRL/YEL YOUR NAME";
40 GO TO 10
50 END
RUN
```

Press RUN/STOP to stop program.

Filling Your Screen With Pictures

1. You can use this simple program to fill the screen with all kinds of graphic symbols that are printed on the fronts of the keys.

```
NEW
10 PRINT "CTRL/RED SHIFT/SS";
20 PRINT "CTRL/CYN SHIFT/XX";
30 PRINT "CTRL/WHT SHIFT/ZZ";
40 PRINT "CTRL/GRN SHIFT/AA ";
50 GO TO 10
60 END
RUN
```

Press RUN/STOP to stop program.

Placing a Picture Right Where You Want It

The Commodore 64 has another way of specifying the color and location of printed letters and symbols. This uses

the POKE command to tell the computer the place (one of 1000 character positions) and the color of that position. Here is a program using the POKE to put a heart in the middle of the screen and change its color from red to white over and over again.

```
10 POKE 1524,83
10 POKE 55796,2
30 FOR X=1 TO 100: NEXT
40 POKE 55796,3
50 FOR X=1 TO 100: NEXT
60 GO TO 20
70 END
RUN
```

You can change the location of the character by putting in a different number for the 1524 in line 10. The number must be between 1024 and 2023. You can change the character being printed by putting in its character code. Check the Appendix of your COMMODORE 64 USER'S GUIDE for a list of characters. Lines 20 and 40 determine the colors.

Sounds Nice

The Commodore 64 also has a way to make music and sound effects. Listen to this program.

```
10 POKE 54296,15
20 POKE 54273,34: POKE 54272,75
30 POKE 54273,38: POKE 54272,126
40 POKE 54273,43: POKE 54272,52
50 GO TO 20
60 END
RUN
```

PRESS RUN/STOP to stop program. You can change the notes played by putting in different numbers for the second

number after each POKE command. A list of the musical notes and their codes can be found in Appendix M of the COMMODORE 64 USER'S GUIDE.

THE VIC 20™

1. Get your parents to hook up the computer.
2. Find the black on-off switch on the right side of the keyboard and push it to the *ON* position (see Fig. 6-6).
   a. Your screen should look something like this

```
****_____ _____ Bytes Free
Ready
```

3. Notice the blinking blue box near the top of the screen. This is the CURSOR. The cursor is the computer's special mark that tells you where the next character that you press will appear on the screen.
4. Now find the CLR HOME button and press it. This will send the little cursor box to the top left hand corner of the screen, the HOME.

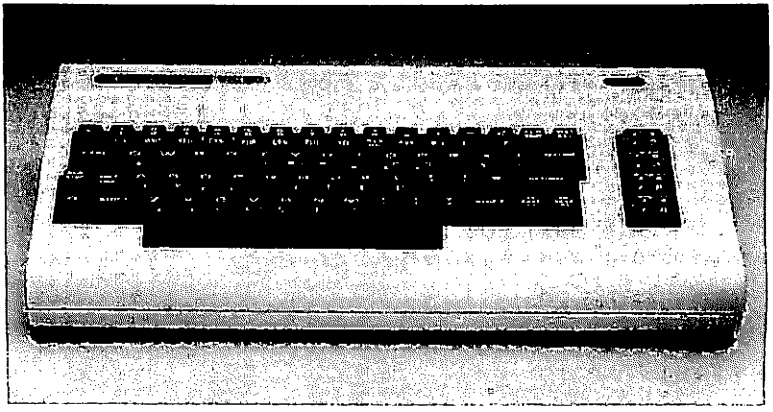


Fig. 6-6. Keyboard of the VIC 20 computer.
(Courtesy Commodore Business Machines, Inc.)

Clearing the Screen

1. Look at your keyboard.
   a. A SHIFT key is located on either side of the keyboard.
   b. A CLR/HOME key (the clear key) is located on the far right hand side of the keyboard.
2. Hold down a SHIFT key and press the CLR/HOME key AT THE SAME TIME. Presto! You have cleared the screen. All that is left is the cursor.

Moving the Cursor

1. You can even move the cursor around the screen. Find the key that looks like this ◄ CRSR ► . Press this key.
2. Now press the SHIFT and ◄ CRSR ► at the same time.
   a. This will make the cursor move up.
3. Find the key that looks like this ▲ CRSR ▼ .
   a. If you press this key it will move the cursor right.
   b. If you press SHIFT and ▲ CRSR ▼ it will move the cursor left.

Here's a neat trick! If you hold the ▲ CRSR ▼ button down the cursor will keep circling the screen and move downwards.

The Screen—How Big Is It

1. Find the letter P and type it across the screen.
   a. How many letters have you typed? You should get 22. This is the number of columns on your VIC 20.
2. Now hit your letter again. NEXT hit the cursor key (not at the same time). Keep repeating this process until you get a string of letters running diagonally across the screen.

3. Now type one extra P. It will appear on the lower left hand corner of the screen.
4. Count all the letters going down including the extra P. You should get 23. This is the number of rows on your VIC 20.
5. Can you guess why your last letter appears on the other side of the screen? The answer is that your screen is not square.

Q. If you filled the screen with letters, how many letters would you have? (Hint: Multiply the number of rows by the number of columns.)
A. The answer is 506.

Correcting an Error

1. Clear your screen by pressing SHIFT .
2. Type your name and make an error by adding an extra E on the end.
3. Move the cursor one character to the right of the character that you want to erase. Then press INST DEL .

For example, you type

Davide ■

Move the cursor here and press INST DEL .

4. If you want to change a letter in a word.
   a. Move the cursor on top of the letter you want to change and type a new letter.

For example, you type

Darid

Move the cursor here and type v.
The computer will print

David.

5. If you want to erase an extra letter from the middle of the word, you can correct it the same way.

   You type

   Davrid

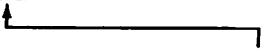
   

   Move the cursor here and press INST/DEL.
   The computer will erase the r.

6. Here is how you can add a letter to a word.
   a. Move the cursor over the letter that will be right after the letter that you want to add.
   b. Hit SHIFT and INST/DEL at the same time.
   c. You will now have a space where a letter can be added.

For example, you type

Daid



Move the cursor here. Now press SHIFT and INST/DEL at the same time. Now type the letter v. The computer will add the v.

Getting Down to Basics

Your VIC 20 does lots of neat things using color graphics and sound. Here are a few simple programs that you can type in.

Filling the Screen With Your Name

1. Clear the screen, by holding the SHIFT key and the CLR/HOME key at the same time.
2. Type NEW and press the RETURN key.
3. Type 1 SPACE PRINT "SPACE
   Then type up to seven letters of your name (if your

name is less than seven letters add extra blanks to make seven). Type "; then press RETURN .

4. Type 2 SPACE GO SPACE TO SPACE 1. Now press RETURN . Your program will look like this:

```
1 PRINT "JENNY ";
2 GO TO 1
```

5. Now type RUN. Your screen will be filling with your name.
6. Now press RUN/STOP to stop the program.

Filling Your Screen With Pictures

1. You can use this simple program to fill the screen with all kinds of super graphics.
2. First type in NEW. This tells the machine that you are starting over with a new program.
3. Now type 1 PRINT " ♆ "; (Hint: to get ♆ hold down SHIFT and X at the same time.) Next type

```
2 GO TO 1
RUN
```

4. Instead of ♆ you can get:
   - ♆ **SHIFT S**
   - ♠ **SHIFT Z**
   - ♇ **SHIFT A**
   - ♌ **SHIFT W**

RADIO SHACK COLOR COMPUTER
HANDS-ON ACTIVITIES

1. Get your parents or teacher to hook up the computer or show you how this is done. Turn on the tv to warm up a few seconds and select Channel 3 or 4. Now look

for the on/off power button on the left back side of your keyboard and push it ON.

The screen should look like this:

COLOR BASIC

© 1980 TANDY

OK

The "OK" is your computer's way of telling you it's ready for your next command. It's called the system prompt. If you have added extra memory to your TRS-80® Color Computer the first message the computer prints out may say "EXTENDED COLOR BASIC."

2. Find the key marked with the word CLEAR. If you press it, the screen will be wiped clean of everything except a little blinking box at the top left hand corner. This blinking box is called the *cursor*. The cursor tells you where the next character that you type will appear on the screen. The position at the top left corner is called the *home* position on the screen.

Introducing Your Keyboard

The keyboard on your Radio Shack Color Computer looks a lot like a typewriter (see Fig. 6-7).

1. The letters on the Color Computer show up as upper case on the screen. Try pressing the T, M, and E keys one at a time. If you have a printer and want your computer to type little letters, you have to press the shift key and the 0 key at the same time. This puts you into lower case mode. Now everything you type will appear in reverse color on your screen. To get out of

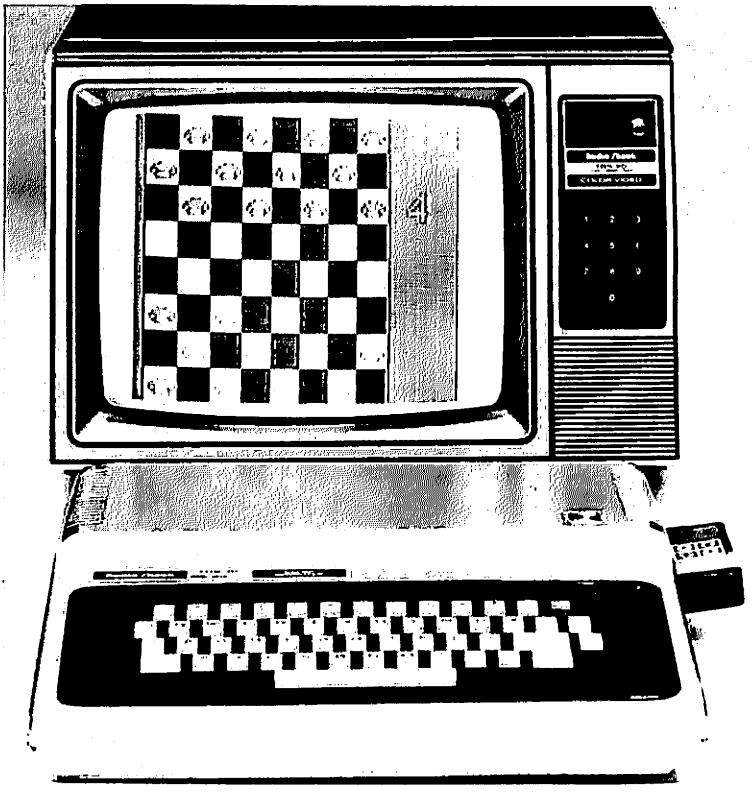


Fig. 6-7. TRS-80 color computer.
(Courtesy Radio Shack, Division Tandy Corp.)

lower case mode, just press the shift key and the o key at the same time again. For most programs and commands on the TRS-80 Color Computer, be sure to use upper case letters.

2. The BREAK key at the top right of the keyboard is used to tell the computer to stop what it's doing and ask for your next command. It's a handy way to stop a program before it's finished.
3. If you clear the screen and then type the letter "P" all across the screen, how many Ps do you get? That is the

number of columns your screen will hold. Clear the screen and press ENTER. Keep on pressing ENTER until the left side of the screen is filled with OKs. How many OKs are there on the screen? This is the number of rows that your screen will hold. Can you guess how many characters your TRS-80 Color Computer can display at one time on the screen? (Hint: Multiply the number of rows by the number of columns to get the right answer—512.)

Getting Down to Basics

1. Correcting an error: When you are typing it's easy to make mistakes. So if you do, here is how to correct them. If you catch a mistake on a line before you press ENTER, just use the back arrow key to back up to the mistake and retype the rest of the line. If you have already pressed ENTER, you can correct the line by typing in the line number and putting the line in again. This puts your correct line in the program instead of the old one. There are other ways of changing information on a line in EDIT mode, but these two methods will do for beginning hands-on activities.
2. If you type in a BASIC command without a line number, the systems will do that command immediately. You can see how well your computer can do arithmetic by typing the following BASIC command:

   PRINT 44+82

   and press ENTER. The computer will respond with 126. Try your own numbers and see what happens.
3. With a simple CLS command, you can change the background color of the screen. Remember to press ENTER after each command.

```
CLS(3)
CLS(8)
```

Any number between 1 and 8 should change the color. Number 3 gives you dark blue, number 8—pink, and number 4—purple.

4. Here is a program to fill the screen with your name. Just type your name in the instruction where it says JENNY.

```
NEW
10 PRINT "JENNY ";
20 GO TO 10
RUN
```

Press the BREAK key when you have seen enough.

5. Your TRS-80 Color Computer also has some graphic symbols as well as letters and numbers. Try making a neat pattern with this program.

```
NEW
10 PRINT CHR$(129) CHR$(128);
20 PRINT CHR$(137) CHR$(143):
30 GO TO 10
RUN
```

Press BREAK to stop the moving pattern.

There are other patterns you can try by changing the number inside the ( ). Look in the back of your users' manual for the numbers for each different pattern.

6. Would you like to hear how your home computer sounds? Well, listen to this program.

```
NEW
10 SOUND 125,5
```

```
20 SOUND 108,5
30 SOUND 89,5
40 GO TO 10
```

Press **BREAK** when you have heard enough. You can play other notes by changing the first number. A complete list is given in the appendix of your *GETTING STARTED WITH COLOR BASIC TRS-80 COLOR COMPUTER* book.

RADIO SHACK TRS-80

1. Get your parents to hook up and turn on the computer (see Fig. 6-8).
2. The screen will show

   Cass?

   a. Press **ENTER** . The screen will show

   Memory Size?

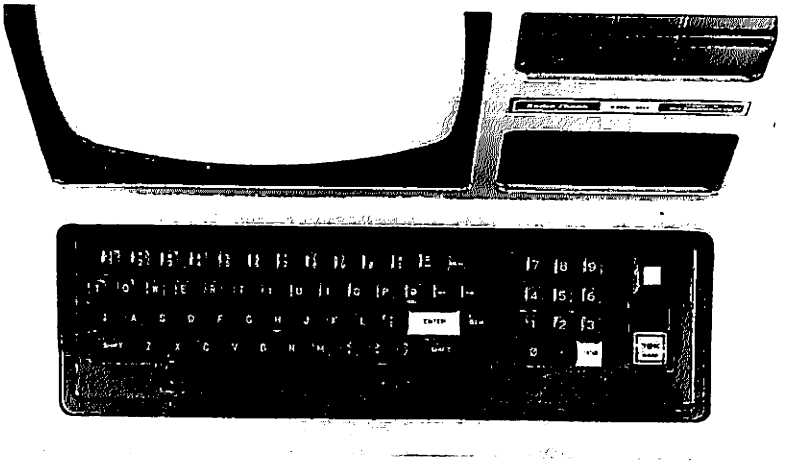


Fig. 6-8. Keyboard of TRS-80 computer.
(Courtesy Radio Shack, Division Tandy Corp.)

b. Press ENTER again. Now your screen will look something like this.

```
Radio Shack Model III Basic
(c) 80 Tandy
READY
> ■
```

2. Notice the blinking box. This is the CURSOR. The cursor is the computer's special mark that tells you where the next character that you press will appear on the screen.

Clearing the Screen

1. Find the CLEAR key. Press it. This will clear the screen and send the cursor box to the top left hand corner of the screen, the HOME.

Moving the Cursor

1. You can move the cursor around the screen. Press the → key.
   a. Notice how the cursor moves to the right.
2. Now press the ← key. This moves the cursor to the left.
   a. Here is a neat trick. Try pressing ← and SHIFT AT THE SAME TIME. This will move the cursor to the far left hand side of the screen.
3. The ↓ key will move the cursor down (↑ does not move the cursor up). Practice moving the cursor around the screen.
4. Want to get back to HOME? Then just press the CLEAR key.

The Screen—How Big Is It?

1. Type the letter P across the screen.
   a. How many letters have you typed? You should get 64. This is the number of columns on your Radio Shack TRS-80.
2. Now hit the P again. Then hit ▼ . Keep repeating this process until you get a string of letters running down the screen.
   a. How many letters have you typed? You should get 16. This is the number of rows on your Radio Shack TRS-80.

Q. If you filled the screen with letters, how many letters would you have? (Hint: Multiply the number of rows by the number of columns.)

A. The answer is 1024.

Double Sized Letters

You may be thinking that those letters on the screen look awfully small. Here is a neat trick! You can double their size.

1. Clear the screen.
2. Now press the SHIFT key and the ↑ at the same time.
3. Next type your row of Ps. Count them.
   a. You should have only 32.
4. To get back into small print just press CLEAR again.

To Correct an Error

1. Clear the screen.
2. Type your name with a mistake at the end.
   a. Move the cursor back one space using the ← key. The extra e will be erased.

b. If you keep pressing the ◄ key the whole word will be erased.

Want to change a letter in a sentence without retyping the whole thing? All you need to do is get into EDIT mode. Here is how you do it.

1. Type a sentence with an error in it. Be sure to put a number such as 10 or 100 at the beginning of the sentence.
   For example you type

   ```
   100 My name is Darid
   ```

2. Now type EDIT 100.
   a. You are now in edit mode and the computer is ready to edit line 100.
3. To change the Darid to David, press the space bar until your whole sentence appears on the screen.
4. Use the ◄ to erase rid from the screen. (Note that it's only been erased from the screen, it's still in the sentence, though. If you were to press the space bar it will appear again.)
5. Now press C. This tells the computer that you want to change the character.
6. Next press your new letter, in this case it is V.
7. Now press V again. This is a message to the computer saying that you have just typed your new letter. The screen will show

   ```
   David
   ```

Want to erase a letter in the middle of a word?

1. Repeat steps 1–4 above.
2. Now press D for delete.

a. The screen will show DA!R!
b. The exclamation points mean that R has been removed.
c. Press L and ENTER . The screen will show

```
100 My name is Daid
```

Now if you want to insert a new letter in the word just follow these simple steps.

1. Use the ◄ to erase id from the screen.
2. Now type I (this means "I want to insert a new letter").
3. Next type your new letter, in our example it would be v.
4. Now press SHIFT and ◄ at the same time.
   a. This takes you out of insert mode and shows the new letter.

Want to leave Edit mode? Just press the ENTER key.

Here is another real simple way that you can edit a line. This method is especially good if you have made a lot of errors.

1. You can change your line without entering edit mode.
2. Just retype your line, remembering to put the number in the front. Then press ENTER .
3. Now type LIST and press ENTER . Presto! Your line has been replaced.

Filling the Screen With Your Name

1. Begin by clearing the screen and erasing any programs that the computer currently has in its memory.
   a. To do this type NEW and press ENTER .

2. Next type in:

```
100 PRINT "JENNY";
200 GO TO 100
```

3. Now type RUN. Your screen will start filling with your name.
4. Next press BREAK. This will stop your program.
5. If you made an error and want to see your typed program again, just type LIST and press ENTER.

Graphics

You can do lots of neat graphics with your TRS-80. Here is a simple program that you can type in.

1. First clear your screen and memory.
2. Now type in:

```
100 PRINT CHR$(173) CHR$(183);
200 PRINT CHR$(179) CHR$(166)"35";
300 GO TO 100
```

3. Now type RUN. Your screen will fill with a graphics design.
4. You can use this same program to run different graphics patterns by simply changing the numbers in the parentheses. Each number represents a different graphics symbol. A list of symbols and their corresponding numbers can be found in your computer manual.

TEXAS INSTRUMENTS TI-99/4A HOME COMPUTER

1. Get your parents to hook up the computer.
2. Now turn on your television set and let it warm up a

few seconds. Next switch on your computer. The on/off switch is located on the lower right front of the keyboard.

The screen should look something like this:

TEXAS INSTRUMENTS

HOME COMPUTER

READY-PRESS ANY KEY TO BEGIN

3. Press any key on the keyboard and the system will present you with a list of things you can do. This list is called a menu and looks like this:

TEXAS INSTRUMENTS

HOME COMPUTER

PRESS

1 FOR TI BASIC
2 FOR HANGMAN

NOTE: If you have plugged a software module into the console slot, then the name of that program also appears on your list.

To get into BASIC or any other program, just press its menu number. Press 1 and you will get BASIC.

4. Notice the blinking box on the bottom line of the screen. This is the CURSOR. The cursor is the computer's special mark that tells you where the next character that you press will appear on the screen.

Introducing Your Keyboard

The TI keyboard looks a lot like a regular typewriter (see Fig. 6-9). It has characters that print in lower case (which look like half size capital letters) unless the shift key (alpha lock) is held down. There are also numbers and special symbols like $ and %. But if you look closely, you will find the punctuation as well as a few unusual symbols printed on the front of the keys as well. To tell the computer that you really want one of these front symbols like the ? or the " you have to hold down the FCTN key and at the same time press the key with the ? or ". There are more neat things you can do with the FCTN key and other keys combined.

1. Moving the cursor: Look at the front of the S and D keys. Holding down the FCTN key and one of these letters will move the cursor in the direction of the arrow on the front of each key. FCTN and S will move the cursor left. FCTN and D will move the cursor right. Try these two out for yourself. What happens when you move the cursor all the way to the right

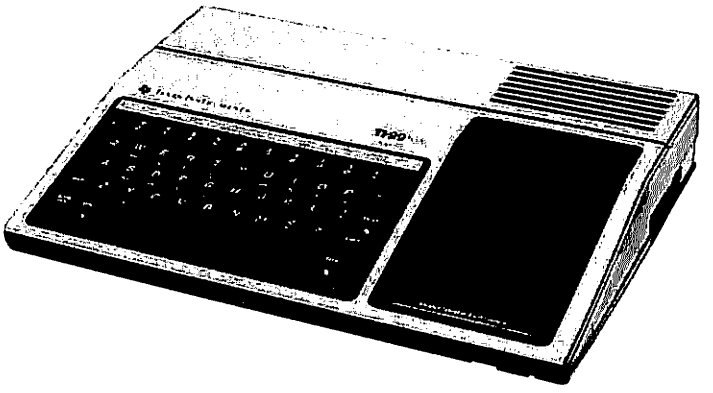


Fig. 6-9. Keyboard of TI 99/4A computer. *(Courtesy Texas Instruments, Inc.)*

of the screen and press the FCTN and D keys together? The cursor will move to the next line on the return to the opposite side of the screen. This is called wrap-around. The TI 99/4A will wrap around for four lines. However, after that, the cursor won't move any further when you get to the right most side. If you are using extended TI BASIC you can wrap around five lines.

2. FCTN and E will make the information on the screen move up one line. In normal input mode, it works like the ENTER key to tell the computer to keep the line you just typed in memory. However, in edit mode, when you are correcting a line of your BASIC program, typing a line number followed by a FCTN and E will give you a copy of that line number.
3. Clearing the screen: You have to use a CALL CLEAR statement to clear the screen. Type:

```
CALL CLEAR
```

And press ENTER. Presto! You have erased everything. All that is left is the cursor.

The Screen—How Big Is It?

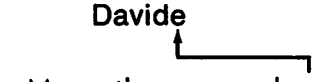
1. Clear the screen with CALL CLEAR. Make sure the cursor is in the HOME position (lower left corner). Now find the letter P and type it across the screen. How many letters have you typed? You should get 28. This is the number of columns on your TEXAS INSTRUMENTS TI-99/4A.
2. Clear the screen again. Now hit the enter key again and a > should appear. By the way, the system used the > as the system prompt. When the computer puts a ">" at the beginning of the line it means that the sys-

tem is waiting for your next command. For this exercise, keep pressing the ENTER key until the left side of the screen is filled with >'s. Now count the number of >'s along the left side of the screen. That is the number of rows on your TI computer's screen. Did you get 24?

If you filled the screen with letters, how many would you have to type? (Hint: Multiply the number of rows by the number of columns.) Your result should be 672.

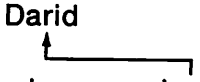
Correcting an Error

1. It's easy to make mistakes when entering a program even if you know how to type and especially if you are hunting and pecking on the keyboard. So it's very important that you know how to correct those kinds of errors. The TI uses the FCTN together with some of the number keys to indicate line editing operations such as inserting and deleting characters.
2. Type your name but make an error by adding an extra E on the end. To correct the mistake, move the cursor over the extra E. Then press the FCTN and the 1 keys at the same time. And like magic, your typing error has disappeared. If you want to remove more than one letter, just position the cursor and hit the FCTN and 1 keys for each letter you want to delete. This works no matter where the error is; just be sure the cursor is right on top of the letter you want to erase.



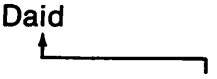
Move the cursor here and press FCTN and 1 at the same time.

3. If you want to change a letter in a word just move the cursor on top of the letter you want to change and type a new letter.



Move the cursor here and type v.

4. If you want to add a letter to a word, move the cursor over the character immediately to the right of the place where you want to put the new character. Then press the FCTN and 2 keys at the same time. This puts your screen in INSERT mode which means that when you type in a new letter, the cursor and all the letters to the right of it will move over one character to make room for the new letter. When you have finished adding the new characters, then press FCTN and D to turn off the INSERT mode. (Actually, pressing FCTN and any of the special function characters except QUIT will get you out of INSERT mode.)



Move the cursor here and press the FCTN and 2 keys at the same time. Now type v. Press the FCTN and D keys to get out of INSERT mode.

Getting Down to Basics

Your TEXAS INSTRUMENTS TI 99/4A can do a lot of neat things using color, graphics, and sound all from simple BASIC programs. Here are a few easy BASIC programs for you to try.

Filling the Screen With Your Name

1. Clear the screen using CALL CLEAR and go to the HOME position. Type NEW and press ENTER.
2. Type in these lines but put in your name instead of JENNY.
   Also press ENTER at the end of each line.

```
10 PRINT "JENNY ";
20 GO TO 10
```

3. Now type RUN. Your screen will fill up with your name. To stop this program press the FCTN and 4 keys (CLEAR).

Fun With Color

The TI 99/4A lets you change the color of characters and their background by using the COLOR subprogram. Try running this BASIC program and see what happens. Of course, this will only work if your computer is hooked up to a color tv or monitor.

```
NEW
10 CALL CLEAR
20 CALL COLOR (1,5,15)
30 CALL HCHAR(3,3,36,200)
40 GO TO 20
50 END
RUN
```

This program will type 200 magenta $ on a grey background on your screen. In line 20, if you change the number 5 and the number 15 to any other numbers between 1 and 16, you will get different color combinations. Check the write-up on the COLOR subprogram in the TI BASIC manual for a list of all the colors.

If you get a syntax error, it probably means you made a typing mistake. Type LIST and press ENTER. Check over the program carefully. When you have found the mistake, type in the line number of the error and press FCTN and E and the line will be displayed for you. Now correct that line and press ENTER and try running the program again.

Sounds Nice

To use the sound features of your TI 99/4A, you will need to call the SOUND subprogram and tell it which tones you want. Here is a simple BASIC program for playing three notes over and over again.

```
NEW
10 CALL SOUND (+200,330,0)
20 CALL SOUND (+200,294,0)
30 CALL SOUND (+200,262,0)
40 GO TO 10
50 END
RUN
```

To turn the music off, just type FCTN and 4 (the CLEAR function) and this will stop the program. You can change the notes, the length of the sound, and the loudness by changing the numbers inside the ( ). The first number tells the computer how quickly or slowly to play the note. The second number says what note to play. There is a list of the notes and their corresponding number in the appendix of your USER'S REFERENCE GUIDE. The third number tells the system how loud to play the note with 0 being the loudest and 30 being the quietest.

TIMEX SINCLAIR

1. Get your parents to hook up the computer, and set it to the correct channel on your television set.
2. Turn on your tv set (see Fig. 6-10).
   a.Your screen will look like this

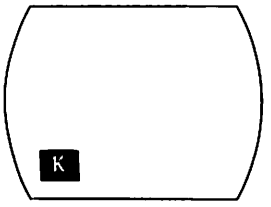


Fig. 6-10. Keyboard of Timex Sinclair computer.
(Courtesy Timex Computer Corp.)

b. Your tv will also make a low hum; you can turn off the hum by turning your tv volume way down.

3. Notice the black box with the K in it. This is the CURSOR. The cursor is the computer's special mark that tells you where the next character that you press will appear on the screen.

K Means Keyword

1. Look at your keyboard. Most of the keys have a large number or letter, and several symbols on them. Each key also has a word printed above and below it.
2. Now look at your cursor. It has a letter K in it. The K stands for keyword.
   a. A keyword is the word printed above the key.
3. Press the P. The word above the letter P, PRINT, will appear on your screen.
   a. When the cursor has a K in it, and you press a key, the computer will follow the instructions of the keyword printed above that key.

4. Notice that once you press P for print the letter in cursor changes to L. Now when you press a key the computer will display the number or letter on that key.
5. Now you can type in your name.

Clearing the Screen

1. When you are in the L mode it's easy to clear the screen.
2. Just press the ENTER key. The computer will show 2/0. Now press ENTER again. The cursor is back in the K mode. The screen is cleared.
3. If you are in the K mode and you want to clear the screen, press SHIFT and DELETE at the same time. Keep doing this until you erase all the letters on the screen.

Moving the Cursor

1. You can move the cursor around the screen. First type P PRINT and type a sentence onto the screen. Next find the 5 key. Now find the SHIFT key.
2. Press the SHIFT key down and hold it.
   a. Now press the 5 key at the same time.
   b. Each time you press the 5 and SHIFT key at the same time the cursor will move left.
3. Now find the 8 key. If you press this with the SHIFT key it will move the cursor to the right.

The Screen—How Big Is It?

1. Press the SHIFT key and the K+ key at the same time. This will put a + on the screen. Keep doing this until you get a row of +'s running across the screen.
2. Now count the +'s. You should get 32.
   a. This is the number of columns in your Timex Sinclair.

3. There are also 22 rows on your new computer.
   Q. If you filled the screen with +'s, how many +'s would you have? (Hint: Multiply the number of rows by the number of columns.)
   A. The answer is 704.

Correcting an Error

1. Clear your screen by pressing the FUNCTION/ ENTER key to get into Keyword mode.
   a. Now press A and FUNCTION/ENTER.
   b. Press P to get into Print mode.
2. Type your name and make an error by adding an extra E on the end.
   a. Move the cursor one character to the right of the character that you want to erase. Then press DELETE. For example, you type David L.

      Move the cursor here and press DELETE.
      The computer will show David.
3. If you want to change the letter in a word.
   a. Move the cursor one character to the right of the character that you want to replace. Then press DELETE.
   b. Now type your new letter.
      For example, you type Darid

      Move the cursor here and type DELETE.
      The computer will show Dalid.
      You type V.
      The computer will show
      David.
4. Here is how you can add a letter to a word.
   a. Move the cursor to the spot where you want to add the letter.
   b. Now type in your new letter.

For example, you type Daid

Move the cursor here.
The computer will show

Dalid.

You type the letter V and move the cursor just to the right of your word.
The computer will show David.

Getting Down to Basics

Your TIMEX SINCLAIR does lots of neat things using basic programs. Here are a few simple programs that you can run.

Filling the Screen With Your Name

1. Clear the screen by pressing the FUNCTION/ENTER key. Then press NEW (the A key) and FUNCTION/ENTER again.
2. Now type your basic program.
   a. Type EDIT DELETE SPACE PRINT (the P" key).
   b. Now press SHIFT and hold it down, press P" at THE SAME TIME (the computer will print ").
   c. Now type your name. Next type SPACE and press SHIFT and P" at the same time. Then type SHIFT and X; . Type ENTER (the FUNCTION/ ENTER key). The computer will show.

```
10 PRINT "JENNY";
```

3. Continue the program by typing AND DELETE SPACE . Then type GOTO (the LIST key) SPACE EDIT DELETE .
   a. Type ENTER (the FUNCTION/ENTER key). The computer will show

```
20 GOTO 10
```

4. Now type RUN (the R key) and FUNCTION/ENTER. Surprise! the screen is filled with your name.

   Did you make an error in typing in your program? Here is a simple way to edit it.

Editing a Program

1. Press K+ and FUNCTION/ENTER.
   a. The computer will list your program.
2. Now press SHIFT and either 6 or 7 at the same time. This will move the > cursor from line to line.
3. Move the cursor to the line that you need to correct.
   a. Now press SHIFT and EDIT. The line will appear at the bottom of your screen.
4. Now you can move your cursor along this line.
   a. Press SHIFT and 8.
5. Edit the line the same way you normally would.
   a. Move the cursor just to the right of a letter that you want to erase and press SHIFT and DELETE.
   b. Or, move the cursor to the spot where you want to add a new letter and press the letter you want to add.
   c. Now press FUNCTION/ENTER. Presto! The new line will replace the old line.

Filling the Screen With Pictures

1. You can use this simple program to fill the screen with all kinds of super graphics.
2. Clear the screen.
   a. Press FUNCTION/ENTER.
   b. Then press NEW (the A key) and FUNCTION/ENTER again.
3. Now type your program.
   a. Type EDIT DELETE SPACE and PRINT (the P" key).

b. Next press SHIFT and P" at the same time.

4. Now put the computer into graphics mode by pressing SHIFT and GRAPHICS at the same time.
   a. next choose your graphics key, by pressing SHIFT and T at the same time.
   b. Now press SHIFT and GRAPHICS at the same time. This will take you out of graphics mode.
5. Continue typing the first line of your program.
   a. Press SHIFT and P" at the same time.
   b. Then press SHIFT and X; at the same time. Your screen will show

      10 PRINT " ■ ";

6. Next type in your second line just as you did in the last program.
   a. Your computer should show

      20 GOTO 10

7. Press ENTER and RUN (the R key) and ENTER again. Look, your screen will be filled with graphics.

You can use this same program with any of the graphics keys that you like. Just follow the preceding program and when you get to step 4.a., choose the key with the square pattern that you like best on it and press it instead of T. Your screen will fill with the graphics pattern of your choice.

IBM® PC HANDS-ON ACTIVITIES

1. To get your computer ready for these activites you have to put your DOS (Disk Operating System) diskette into drive A. Drive A is the one on the left-hand side. The disk should be label side up with the label closest

to you and the oval hole side inserted first. Now close the drive door by pushing the lever down. If you have a printer, turn it on. Your screen may have its own power as well. If it does, then turn it on. Now look for the computer's power on switch located on the right side of the computer and flip it on. Your screen will display the following messages and ask you for the correct date and time.

```
Current date is Tue 1-01-1980
Enter new date: 3-20-1983
Current time is 0:01:33.15
Enter new time: 10:00:00

The IBM Personal Computer DOS
Version 1.10 (C)Copyright IBM Corp 1981, 1982
A>
```

2. After you have answered the date and time questions, the PC will put the system prompt of A > on your screen. This tells you that the computer is ready for your next command and that if you don't specify disk drive A or B, it will assume you mean drive A. Anytime the system assumes something for you, this is called a default. You can change the default drive by typing in the following: b: and press the return ↵ key (see Fig. 6-11). Now the default drive is B and the prompt will look like this: B>
3. Set the default drive back to A if you changed it in step 2.
   Now type:
   dir
   (and press RETURN)

   The system will list the directory of all the files on the DOS disk you have in drive A. Are you ready to run a

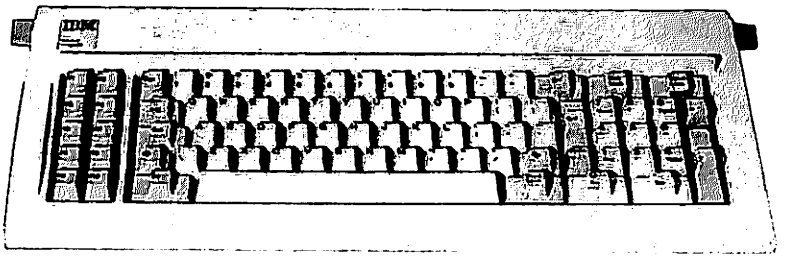


Fig. 6-11. Keyboard of IBM personal computer.
(Courtesy Howard Buckholtz)

sample program or two? Type the following command and a list of sample basic programs will be presented for you to choose from.

basic samples

(and press return).

Your screen should look like this:

```
IBM

Personal Computer

SAMPLES

Version 1.10

(C) Copyright IBM Corp 1981, 1982

Press space bar to continue

SAMPLE PROGRAMS
A - MUSIC                (48k)
B - ART                  (32k-Color/Graphics)
C - MORTGAGE             (48k)
D - CIRCLE               (BASICA-Color/Graphics)
E - DONKEY               (BASICA-Color/Graphics)
```

F - PIECHART (BASICA-Color/Graphics)
G - BALL (BASICA-Color/Graphics)
H - COLORBAR (32k)
I - CALENDAR (32k)
J - SPACE (BASICA-Color/Graphics)
ESC KEY - EXIT

ENTER LETTER OF PROGRAM

NOTE: All of the above programs require 48k if using BASICA

Try selection A for Music and the system will give you another menu. Type any letter a–k and your computer will play a song. When you have heard enough, press the Esc key and you will go back to the first sample menu. You can try as many of the sample programs as you like. However, some of the programs need a color monitor and graphics adapter to run. They will let you know if you don't have the right equipment.

When you have tried out enough sample programs press the Esc key to exit back to basic.

Introducing Your Keyboard

1. Your IBM PC keyboard looks like a typewriter keyboard and an adding machine rolled into one. The letters print in lower case (little letters) except when the shift key (↑) is pressed. You can make the letters all print as big letters if you press the CAPS LOCK key first. There are also numbers and special characters on the top row of the keyboard. To the far left side of the keyboard, you will see keys marked with F1–F10. These are called function keys and are used by different programs such as BASIC to give you a short-cut way of doing some often used commands.

2. The blinking line on the screen is called the cursor. It tells you where the next character you type will appear on the screen. Press the HOME key on the right. The cursor will go to the top left hand corner of the screen, called the home position. You can also move the cursor around the screen using the cursor positioning keys on the right. The ↑ moves the cursor upward; the ↓ downward; the → to the right; and the ← to the left.

Correcting an Error

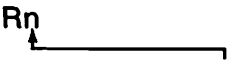
1. When typing in a program it's very easy to make a mistake. But luckily with your IBM PC, it's also very easy to correct mistakes.
2. If you notice the mistake before you type return, you can just use the backspace key (←) to erase back to your error and then type it correctly.
3. To correct a single character mistake, move the cursor over the error, and type the right character over it.

Move the cursor here and type an a.

4. To delete a character, move the cursor over the letter you want to erase and press the DEL key.

Put cursor here and press DEL key.

5. To insert one or more characters, move the cursor over the letter immediately to the right of where you want to put the new characters. Press the INS key which puts you into insert mode. Now type in the new letters. Everything to the right of the cursor moves over to make room for the new entries. When you have finished adding characters, press the INS key again to turn insert mode.



Move the cursor here. Press the INS key and type "ya". Now press the INS key again.

Getting Down to BASIC

1. Now you are ready to try your hand at a few simple BASIC programs. You will notice at the bottom of your screen are some bright boxes with functions such as LOAD and RUN in them. These tell you what the function keys will do for you. BASIC uses the OK as its prompt to tell you it's ready for your next command.

   The IBM Personal Computer Basic
   Version D1.10 Copyright IBM Corp. 1981, 1982
   61371 Bytes free
   OK

   1LIST 2RUN 3LOAD" 4SAVE" 5CONT 6,"LPT1
   7TRON 8TROFF9KEY 0SCREEN

2. If you type a BASIC statement without a line number, the system will do that command immediately. However, if you type a line number before the statement, the system will keep it as part of your program and will perform that command when you type run or press the F2 key.
3. Clearing the Screen: To clear the screen type CLS and hit return. Pressing the CTRL and HOME keys at the same time also clears the screen and sends the cursor to the home position.
4. You can type your basic commands using either upper or lower case letters.

Filling the Screen With Your Name

1. Clear the screen by typing

   CLS

and hit return. Now type the program, but use your name instead of Jenny. Remember to press return at the end of each line.

```
NEW
10 PRINT "Jenny ";
20 GO TO 10
```

2. Now press the F2 key (or type RUN). Your name should fill up the entire screen. To stop the program, press CTRL and the BREAK key in the upper right hand corner.

Hearts and Smiles

Here is a program to brighten up your day.

```
NEW
10 PRINT CHR$(1) " " CHR$(3);
20 GO TO 10
```

Press the F2 key and watch as hearts and smiling faces parade across your screen. To stop the program, press the CTRL and BREAK keys at the same time.

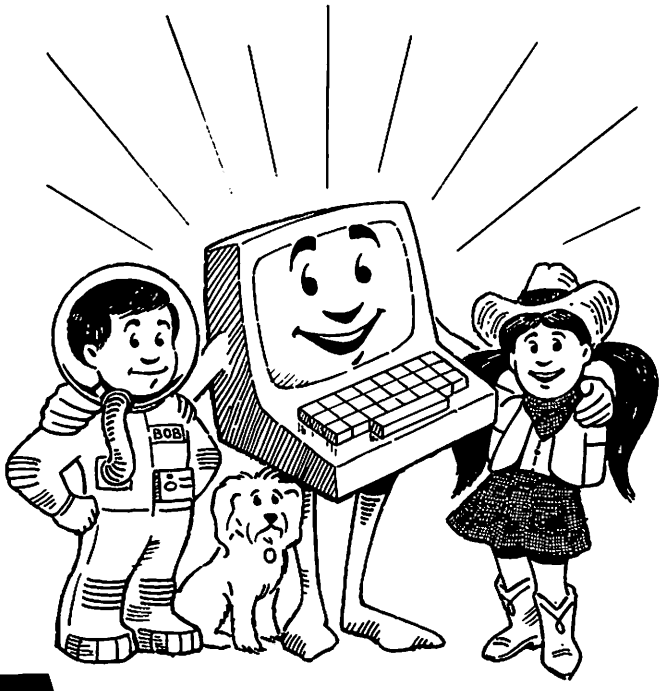
Sounds Great

The IBM has a very easy way to play your favorite songs. Use the PLAY command and put the letters of the musical notes of the song between "". Can you name these tunes?

```
new
10 play "ccggaag..ffeeddc.."
Press F2


10 play "ccdeced"
Press F2
```

You can program your IBM PC to play a lot of different songs by using a beginner's song book and putting in the letters of the notes. The dots after the letters are used to tell the system how long to hold the note. You can also change the octave and add pauses as well. More details are given in the BASIC reference guide under the PLAY command.



A Answers

Chapter 1
Q 1-1 CAGE
Q 1-2 FACE

Chapter 2
Q 2-1 A program to add three numbers.

```
10 READ A, B, D
20 LET C=A+B+D
30 PRINT C
40 DATA 87, 66, 25
50 END
```

Q 2-2 Program to subtract two numbers

```
10 READ A, B
20 LET C= A-B
30 PRINT C
40 DATA 100, 25
50 END
```

Q 2-3 A program to figure out how old you will be in the year 2000. To run this program we will use the following variables:

A= Your age today
B= The year it is now

```
10 READ A,B
20 LET C= 2000-B
30 LET D= A+C
40 PRINT D
50 DATA 10, 1984
60 ENDS
```

Q 2-4 These statements are decision makers:

30 IF nighttime THEN go to sleep
40 IF A=12 THEN go to 10
70 IF your score = 100 THEN you win ELSE you lose

The portions of the statements that are underlined are the condition parts. The portions of the statements that are not underlined are the action parts.

Q 2-5 The bug is in line number 20. It should say:

```
20 D= A+D+C
```

Q 2-6 The bug is in line 30. It should say:

```
30 IF B>=A THEN PRINT B
```

Chapter 3

Q 3-1 Here are a few ways that computers can be used around the house.

Sewing Machines	Telephones
Dishwashers	Refrigerator
Thermostat	Lights
Microwave Oven	Television
Burglar Alarm	Car
Fire Alarm	Clock
Lawnmower	

Chapter 5

Q 5-1 Tic Tac Toe

False	False	False
True	True	True
False	True	False

Q 5-2 Break the Code

Q. Why is a computer like an elephant?

A. Because both never forget.

Q. Why did the computer operator tear the input cards into tiny pieces?

A. Because he thought that the computer needed to get all its information in little bits.

Q. Why did the man spray insecticide all over his wife's computer terminal?

A. Because she kept complaining that her programs were full of bugs.

Q. Why did the kid soak his computer terminal in fabric softener?

A. Because he wanted to make it into software.

Q 5-3 Jumble

SACBI	B A S I C	7
TPUOTU	O U T P U T	10 1 8
AATD	D A T A	4
EMOYMR	M E M O R Y	3 2 9

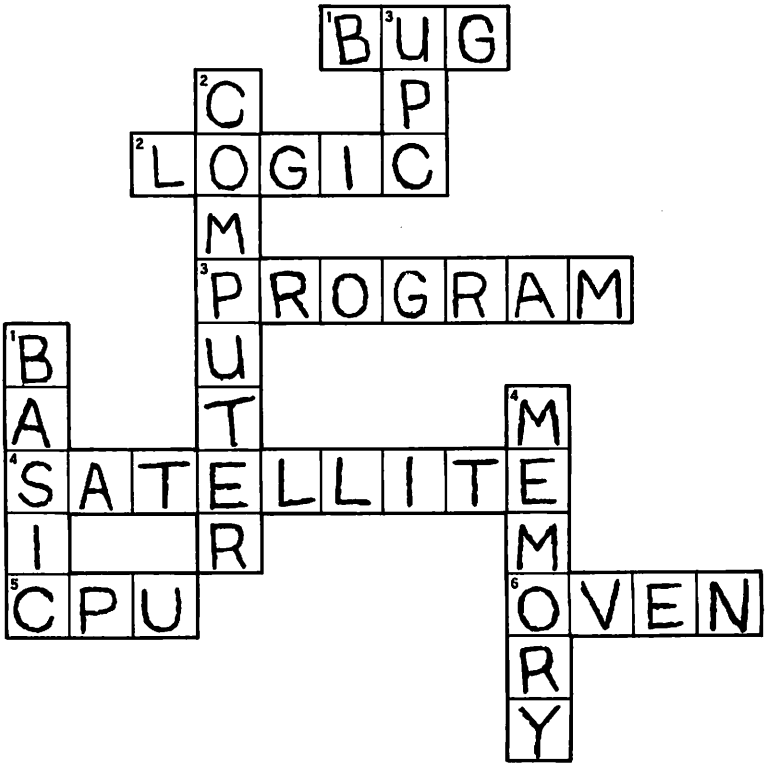
YKES K E Y S
5

INEL L I N E
11 6

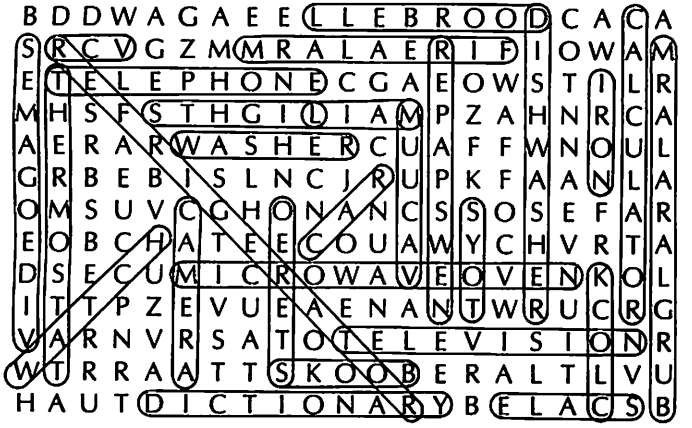
Q. Why did the boy put sneakers on his computer program?
A. Because he wanted

T O M A K E I T R U N
1 2 3 4 5 6 7 8 9 10 11

Q 5-4 Crossword



Q 5-5 Word Find



Q 5-6 Teacher's Grade Book

The answer is VACATION

Q 5-7 Find the Bug

There are two bugs. Line 40 should read:

40 IF A< 80 AND A >=70 THEN PRINT "GRADE IS C."

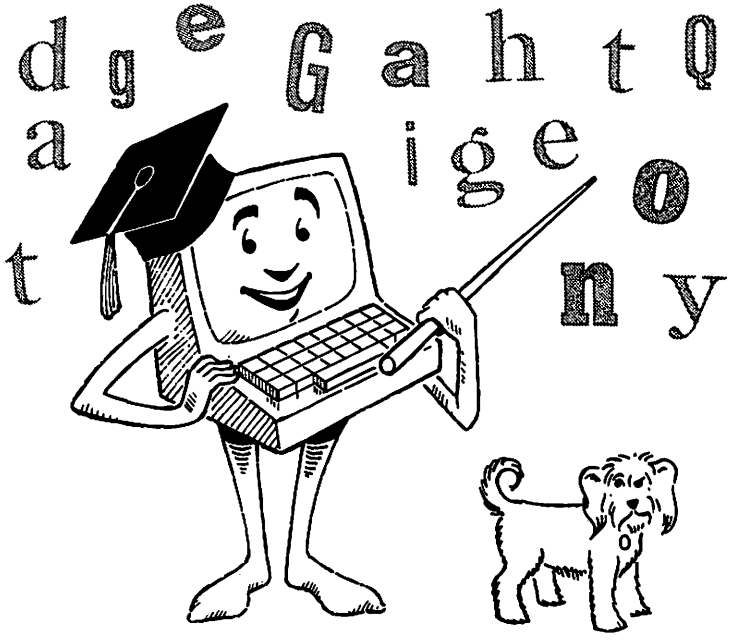
Line 50 should read:

50 IF A< 70 THEN PRINT "GRADE IS F."

Q 5-8 Find the Bug

Line 60 should read:

60 IF A>=B THEN C=1



B Glossary

Artificial Intelligence—A branch of computer science where scientists are developing "smart" machines that can function as experts.

Bar Codes—Black and white thin and thick bars on items that are used by the computer for identification. See Universal Product Code entry for example.

BASIC—Beginners All Symbolic Instruction Code is a very simple programming language used on most home computers.

Byte—A group of bits (usually 8). The size of a computer's memory is often measured in bytes.

Binary Code—A code that only uses the two digits 0 and 1. The internal workings of the computer are based on binary numbers.

Bit—A single binary digit place. Usually a group of bits form a binary code that represents a number or letter.

Bug—Anything that keeps a program from working correctly. Bugs can be caused by both hardware and software problems.

Central Processing Unit (CPU)—The workhorse of the computer system. It adds, subtracts, multiplies, divides, and can even determine if a statement is true or false.

Chip—Small pieces of silicon that contain thousands of circuits, transistors, and other electronic components. A chip might hold the main memory of a computer or be its math wizard CPU.

Constant—A value that never changes during a program. A constant can be a number or one or more letters.

Cursor—A symbol, often a blinking box, which tells you where the next character you press will appear on the screen.

Data Base—A collection of information that is organized in a useful manner.

Debugging—The process of getting the mistakes out of a program.

Electronic Funds Transfer—The transfer of funds between banks using computers instead of paper money.

Electronic Mail—The sending and receiving of letters and other correspondence via computers across phone lines instead of from the mail carrier.

Hardware—The physical parts of the computer such as the screen, the keyboard, the CPU, disk drives, printers, joysticks, etc.

Heuristic Learning—A way computers can learn from their mistakes by eliminating unsuccessful or unproductive options from their programs.

Input—Data that the computer uses to perform its tasks.

Input Devices—Machines that get information into the computer such as the hand control on a video game, a light pen, a punched card reader, a keyboard, etc.

Inventory Control—A way of keeping track of how many units of each item have been sold and automatically reordering when the stock becomes low. Many businesses use computers for inventory control.

Memory—The place where the computer keeps its instructions and other information. Chips, magnetic tapes, and disks are examples of computer memory.

Microprocessor—A tiny computer that fits on a single silicon chip. It's the heart of today's modern computers.

Operator—A symbol used in arithmetic, relational, or logical instructions.

Optical Scanner—An input device that sees and reads a bar code or special character set.

Optical Character Reader—An input device that sees and reads characters or numbers into the computer.

Output—The answers or results that a computer produces.

Output Devices—Machines that display or give out information from the computer such as a tv screen, a printer, a speech synthesizer, etc.

Process—All the things that a computer has to do to the input to produce the desired results.

Program—The detailed instructions that a computer uses to do its job. Also called software.

Programmers—The people who give the computer its instructions and tell the computer how to perform its tasks.

Random Access Memory (RAM)—The main memory of a computer that is used to keep information such as programs and data while the computer is processing them. This type of memory can be written on and is used to temporarily hold information that can change.

Read Only Memory (ROM)—A type of memory that can only be read and is used to keep things that are not to be changed such as the software that runs a video arcade game or the instructions that tell a computer how to run BASIC.

Robotics—A field that combines robots and artificial intelligence to produce walking, talking machines with intricate arms and legs capable of working on assembly lines and other industrial applications. In the future, robots may be commonplace household helpers, as well.

Software—The smart part of the computer that gets all the hardware units working together. The software is a set of instructions that tells the hardware what to do and when to do it.

Speech Synthesizer—A mechanical voice box that allows computers to talk out loud to you.

Top-Down Design—An approach to problem solving that starts with the big problem and subdivides it into smaller and easier to understand tasks.

Universal Product Code (UPC)—A bar code found on many foods and products, used by the computer to identify each item at the check out counter.

User Friendly—A phrase used to describe computer systems or programs that are easy to learn, give clear instructions, and are helpful when you make a mistake or don't know what to do next.
Variable—A name used to represent a value that can change while the program is running. "A", "D", "B$" are examples of variable names in BASIC. In BASIC, variables that end with a $ are used for character values; the variable names with just letters like A, B, or X are used for numeric values.

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